88-05423/

1987 ANNUAL REPORT

ALBERTA SPECIAL CROPS AND HORTICULTURE RESEARCH CENTER

Alberta
AGRICULTURE

1987 ANNUAL REPORT

ALBERTA SPECIAL CROPS AND HORTICULTURAL RESEARCH CENTER

BAG SERVICE 200
BROOKS, ALBERTA
CANADA TOJ OJO

Telephone:
(403) 362-3391

"GOLDEN PRAIRIE ARBORETUM"

TABLE OF CONTENTS

DIRECTOR's REPORT 1

ADMINISTRATIVE SERVICES SECTION 3

SITE OPERATIONS SECTION 3

HORTICULTURAL CROP PRODUCTION SECTION 4

- Potato Program 4
- Alberta Seed Potato Program 9
- Vegetable Program 10
- Fruit Crops Program 14
- Ornamentals Program 16
- Greenhouse Crops Program 19

SPECIAL CROPS AND AGRONOMY SECTION 21

- Special Crops Program 21
- Field Crops Program 25
- Soil and Water Agronomy 28

CROP PROTECTION AND UTILIZATION SECTION 31

- Plant Pathology Program 32
- Post-Harvest Program 36
- Food Processing and Quality Evaluation Program 40
- Weed Control Program 42
- Regional Crop Laboratory Program 45
- Regional Crop Laboratory Program - Olds 47
- Entomology Program 50

PUBLICATIONS AND PRESENTATIONS - 1987 53

APPENDIX I. 62

DIRECTOR'S REPORT

The Alberta Special Crops and Horticultural Research Center (ASCHRC) is a branch of the Plant Industry Division in Alberta Agriculture. The Center, located at Brooks with additional facilities at Olds, has province-wide responsibility for research and extension in horticultural and special crops. It works closely with other segments of Alberta Agriculture, particularly the Alberta Tree Nursery and Horticulture Centre, the University of Alberta; Agriculture Canada; Alberta Colleges with horticultural programs; other Alberta Government departments; grower associations, and individual producers.

The year 1987 has been one of significant change at ASCHRC. Most importantly was the adoption of a new name, the Alberta Special Crops and Horticultural Research Center. This name change reflects a changing commitment to crop diversification and to evaluation of new non-traditional crop kinds. A Special Crops and Agronomy Section was created to accommodate this redefined emphasis.

Numerous staff changes, due to retirements, transfers and resignations, occurred in the past year.

Evert Borkent (Farm Manager), Berend Witteveen (Mechanic) and George Smith (Technologist) retired in June. Colin McKenzie (Research Agronomist, Soil and Water) and Neil Clark (Technologist) were transferred to ASCHRC from the Conservation and Development Branch in April.

Terry Smyrl (Food Scientist), Gordon Grant (Greenhouse Specialist), Marilyn Dykstra (Diagnostician), Ken Mallett (Post-Harvest Physiologist), Brendan Casement (Research Horticulturist, Ornamentals), Rick Rumney (Technologist) and Vicky Rumney (Technologist) all resigned their positions to take up employment with other agencies.

Henry Najda (Research Agronomist, Field Crops), Nancy Crowe (Food Scientist), David Kaminski (Diagnostician), Joe Chomistek (Site Manager), Roland Williams (Senior Mechanic) and Jim Jones (Entomologist, Crop Protection Branch) all joined the staff in 1987. Several positions remained vacant but are under recruitment. These vacancies have interrupted research programs in a number of areas.

A number of field days were conducted in 1987, including the annual field day on August 28, which attracted 2,200 visitors.

Considerable time was spent by staff in co-operation with the Project Management staff of Alberta Public Works Supply and Services in planning a laboratory addition to and renovation of the P.D. Hargrave Building. Construction start-up is expected in summer 1988.

Thomas R. Krahn, M.Sc., P.Ag.

ADMINISTRATIVE SERVICES SECTION

This section provides administrative support to the Center including purchasing, accounting, budget control, personnel services, library and hostess activities, computer and electronic data services, general office management and services as the formal contact with Property Management staff of Alberta Public Works Supply and Services.

Thomas R. Krahn, B.Sc. (Ag), M.Sc., P.Ag. ..... Director
Huber Ellis ..... Administrative Officer
Priscilla Petersen ..... Secretary & Personnel
Anna Moeller ..... Accountant
Betty Ann Humphreys ..... Receptionist & Timekeeper
Joyce Clark ..... Librarian & Hostess

SITE OPERATIONS SECTION

This section is responsible for the grounds program, farm operations, machinery/vehicle maintenance and shop operation and activities of the Center's stockkeeper (including the Safety Program). Site development, shelterbelt maintenance, planning and planting, irrigation system maintenance, mechanical preventative maintenance, land preparation and weather services are major areas of responsibility.

Joe Chomistek, B.Sc. (Ag), P.Ag. ..... Site Manager
Henry Christesen ..... Farm Manager
William Coffey ..... Stockkeeper
Roland Williams ..... Senior Mechanic
Berry Merkl ..... Mechanic
David Houseman ..... Farm Worker
Ludolf Velting ..... Farm Worker
William Wise ..... Farm Worker
Greg Feth ..... Grounds Technologist

HORTICULTURAL CROP PRODUCTION SECTION

Programs in the Horticultural Crop Production Section provide research and extension services for Alberta's horticultural industries. The objectives of the section are: to improve the quality of horticultural crops produced in Alberta; to increase profits for producers by increasing yields and optimizing management inputs; and to promote the development of horticultural crop production. Industries supported include: fresh, processed, and seed potato; fresh and processed vegetable; greenhouse flower and vegetable; nursery and landscaping; and small and native fruit. Most of the programs include both cultivar evaluation and production research. The seed potato program at Olds produces and supplies disease-free, pre-Elite seed tubers to Alberta's seed potato growers. Extension activities include workshops, short courses, field days, study groups, and individual consultation.

Section Administration and Potato Program

Clive A. Schaupmeyer, B.Sc. (Ag), M.Sc., P.Ag. ..... Section Head and Potato Specialist
Mayumi Tanigami-Bunney ..... Secretary
Boyd Hanel, Dipl. Hort. ..... Technologist
Vacant ..... Potato & Vegetable Agrologist

Seed Potato Program

James Letal, B.Sc., M.Sc. (Ag) ..... Plant Pathologist
Will Davies, Dipl. Pl. Sc. ..... Technologist

Vegetable Crops

Paul Ragan, B.Sc.(Ag), M.Sc., Ph.D. ..... Research Horticulturist
Toru Maruno, Dipl. En. ..... Technologist

Fruit Crops

Lloyd Hausher, B.Sc.(Ag) ..... Research Horticulturist
Te-Sen Pih, B.Sc., M.Sc. ..... Technologist

Ornamentals, Nursery Crops

Vacant ..... Research Horticulturist
Nigel Seymour, Dipl. Hort. ..... Technologist

Greenhouse Crops

Vacant ..... Research Horticulturist
Murray Briant, Dipl. Hort. ..... Technologist

POTATO PROGRAM

Program Leader: C. Schaupmeyer
Technologist: B. Hanel

OBJECTIVES

The objectives of the Potato Program are to assist in the selection and development of improved potato cultivars and to establish methods for improving quality and maximizing economic yields in Alberta's potato industry. This is accomplished through research, extension, and service.

RESEARCH PROJECTS

POTATO CULTIVAR IMPROVEMENT

Prairie Potato Regional Trials.

The Center co-operates in the Prairie Regional Potato Trials in the selection of improved potato cultivars for Alberta's potato industry. Approximately 300 cultivars were grown for evaluation in five trials: the Prairie Adaptation Trial contained 169 cultivars with no replication; two Advanced Adaptation Trials contained 56 and 81 cultivars in two replications; the Prairie Early Replicated Trial contained 14 cultivars in eight replications; and the Prairie Replicated Trial contained 17 cultivars in four replications. Data were collected to a maximum of 39 observations and measurements for each entry in the trials. The Center also evaluated 20 cultivars in the North Central Trial.

The data were compiled and transmitted to Dr. Dermot Lynch, the Agriculture Canada potato breeder at Lethbridge. Promising graduate seedlings from the Prairie Potato Regional Trials will be propagated by the Center for industry evaluation in 1988. Results of the regional trials are not published, however, information on clones in the trials may be obtained by contacting the ASCHRC, or Dr. Dermot Lynch, Agriculture Canada, Lethbridge.

Alberta Potato Industry Cultivar Evaluation.

Seed of promising graduate lines from the Prairie Regional Potato Trials were propagated in 1986 at ASCHRC and given to the Alberta Potato Commission in the spring of 1987 for multiplication. Included were seed of A-69868-2, a main-crop French-fry cultivar; W848, which has now been issued a temporary licence as a main-crop chipper; MIN-9632, a main-crop chipper; and NDA 8694-3, an oval russet with some potential for the short-cut fry market. Other cultivars included W847, F76080, F72004, and WIS 74-7.

POTATO PRODUCTION IMPROVEMENT

The results of the research trials discussed below are reported in more detail in Potato Cultural Trials, ASCHRC Pamphlet 88-1.

Evaluation of Nitrogen Levels in Commercial Potato Fields in Southern Alberta.

To determine the effects of nitrogen on the quality of French-fry and chipping potatoes in southern Alberta, tissue samples and agronomic data were gathered from 40 commercial potato fields in 1987. Samples were taken from 20 Russet Burbank and 20 Norchip fields approximately two weeks apart during July and August.

Not all data were analysed for this report; however, there was more variation in the specific gravities between fields in 1987 than in 1986. Again the tissue nitrogen levels were generally within recommended ranges based on previous research at Brooks and elsewhere. Because the levels of tissue nitrogen can decline very rapidly in the time between two sampling dates, it is recommended that growers continue sampling even though initial nitrogen levels are high or even excessive. High levels of nitrogen early in the season appear to have a deleterious effect on the maturity of the tubers as measured by specific gravity and sugar levels.

Comparison of a White-Flowered Clone of the Cultivar Shepody with the Purple-Flowered Cultivar Shepody.

Shepody is a white-skinned, long French-fry potato that has been well established in the southern Alberta potato industry as an early French-fry potato. In 1987 Plant Genetics, Inc., a suppliers of virus-free pre-nuclear potato tubers selected a potato cultivar with similar tuber characteristics to Shepody; however it had a white flower. The 'Shepody' clone was reported to have lighter fry color than Shepody. The yield and quality of the clone and Shepody were compared at ASCHRC in 1987.

There were a number of general differences between the two lines. Although not statistically different both the total and marketable yields of the white-flowered line were higher than those of Shepody. The white-flower line had a mean French-fry score of 4.0 compared with 3.25 for the original Shepody. It must be noted that these apparent differences in yield or fry color may be the result of difference in mean seed-tuber: the white-flowered line having a seed-tuber weight of 9.8 g compared with Shepody with a seed-tuber weight of 5.9 g.

Comparison of the Effects of Seed-Piece Type Distribution in Two Seed Lots on the Yield, Size, and Tuber Numbers of Russet Burbank and Norchip Tubers.

Previous studies at the University of Alberta and ASCHRC comparing grower seed lots have shown that the productivity of individual seed pieces is reduced as the number of cut surfaces on the pieces increase. Two seed lots, defined as variable and uniform, were composed by varying the distribution of seed pieces with differing numbers of cut surfaces. The uniform lot contained 90 percent whole pieces and pieces with one cut surface (halves). In addition to whole and one-cut pieces, 40 percent of the pieces in the variable lot had two and three cut surfaces. The mean seed-piece weight was 60 g for both treatments.

The two treatments were representative of seed that could have been cut from two different lots of uncut seed tubers that varied in mean tuber weight. The uniform cut lot was derived from tubers having a lower mean tuber weight and a maximum tuber size of about 200-250 g, with few tubers above 150 g. The variable lot was derived fr m tubers having a greater mean size and including tubers that were as large as 300-350 g, thus resulting seed pieces with up to three cut surfaces.

There were significant differences between the total and marketable yields harvested from the two seed-lot treatments. Marketable yields of Russet Burbank and Norchip were 15 and 18 percent higher, respectively, from the plots planted with the seed lots defined as being uniform. The mean tuber weight from the treatments were not different and the yield increase was attributed to the significant increase in tuber numbers.

Comparison of the Effects of Planting Date and Depth of Planting on the Yield and Quality of Russet Burbank, Norchip and Superior Potatoes.

The effects of planting dates have never been studied in southern Alberta. There has been a tendency for commercial growers to plant very early with the result that crops are often frozen or seed-piece decay develops. This study will continue for several years and was designed to measure the effects of planting dates in combination with depths of planting.

Seed-pieces of three cultivars, Russet Burbank, Norchip, and Superior were planted on April 21, May 3, May 19, and June 3 at two depths, 15 and 20 cm, as measured below the hill surface formed by the planter. A 10-hour frost of -6°C on May 19 caused severe damage to the Superior plants that were emerged and 10 to 15 cm tall. Superior plots were harvested on July 20, and the other cultivars were harvested on September 22, after being top killed on September 10.

The total yield of Superior was highest from the plots planted on May 3, and the yield from the later-planted plots was significantly lower. Specific gravity and chip scores were also significantly higher from the May 3 planting. The reducing sugars were significantly lower from the potatoes harvested in plots planted at a depth of 20 cm compared with those planted at 15 cm.

There was a significant interaction between the date and depth of planting for the cultivar Russet Burbank. At a depth of 15 cm there were significant differences between the first two planting dates and the last two. At a 20 cm depth, only the last planting date had a significantly lower total and marketable yield. This might suggest that the deeper planting depth will partially compensate for a very late planting of Russet Burbank. There were no differences between dates of planting and specific gravity; however, the gravities from the lots planted at 20 cm were significantly higher than those planted at 15 cm.

The marketable yield of Norchip was significantly affected by planting date with the highest yield produced from the May 3 planting. The yield of potatoes planted 15 cm below the surface was significantly

higher than the yield from those planted at 20 cm. There was, however, a significantly lower chip score from those planted at 15 cm.

From the first year's data it would appear that there are no advantages to planting potatoes before May. In a year without a severe frost the cultivar Superior may yield higher if planted in the later part of April. As there were no significant differences between planting on April 21 and May, 3 growers still have reasonably large planting window so that they can schedule potato planting with the sowing of other crops.

The Effects of Planting Date, Maturity, and Speed of Vine Removal or Vine Desiccation on the Incidence of Stem-End Discoloration and Yield of Russet Burbank and Norchip Potatoes.

Speed of vine removal or desiccation has been linked to internal disorders of potatoes, including stem-end and vascular discoloration. There has been some recent indication that the maturity of the vines instead of speed of vine killing caused internal disorders.

Russet Burbank and Norchip potatoes were planted on three dates, May 1, May 15, and June 19, to affect the maturity of harvested tubers. Plants of both cultivars were either sprayed with diquat to cause slow vine desiccation, or they were instantly removed by cutting.

Although harvested tubers from the late planting were immature as indicated by skin set and yield differences, there was no incidence of either internal disorder in any of the treatments. Therefore no conclusions can be made about the effects of either plant maturity or speed of vine killing on internal disorders. This trial was conducted in 1986 and similar results were obtained, therefore in Alberta there might be some other factor involved in the occurrence of these disorders. Possibly excessive nitrogen, which would tend to delay maturity, could influence the amount of internal discoloration.

The marketable yield of Russet Burbank was significantly lower from the plots planted on May 15 and June 19, than from the plots planted on May 1. The marketable yield of Norchip was lower from the late-planted plot, but there was no significant difference between the yields from the plots planted on May 1 and May 15.

Interaction Effects of Seed-Piece Type and Spacing on the Yield of Russet Burbank and Norchip Potatoes.

To determine effects on yield and tuber size, three seed lots of Russet Burbank and Norchip were planted at four in-row spacings. The seed lots types were composed of only whole tubers, tuber halves, and a mixture of pieces with two and three cut surfaces. All pieces had a mean size of 60 g. Pieces were spaced at 15, 20, 25, and 30 cm.

Data from two years show that close spacing of either whole tubers or halves weighing 60 g will result in acceptable yields of small tubers. This information is useful to seed producers who want to supply seed lots with smaller mean tuber size and few or no tubers larger than 200 g. This trial will continue for one more year in 1988.

ALBERTA SEED POTATO PROGRAM

Program Leader: J. R. Letal
Technologist: W. Davies

OBJECTIVES

This past year, the Alberta Seed Potato Program was primarily involved with the production and testing of "disease-free" seed potatoes. Due to increased workload, very little time was available for research and extension programs.

Extension and Service Activities

In the spring of 1987, 58,663 tubers were distributed to 24 seed producers in Alberta, up 25% from 1986 and 100% from 1985. Ninety-three percent of the demand was for seven cultivars (Russet Burbank 50%, Norchip 18%, Norland 7%, Conestoga 6%, Sangre 5%, Norgold Russet 4% and Superior 3%). Another 14 cultivars accounted for 7% of the distribution.

Pre-elite seed production, which in the past was all field produced, was split: large volume cultivars were produced in the field and small volume cultivars were produced in the greenhouse. This reduced the handling and equipment disinfesting time which is extensive when all the cultivars are grown in the field. A total of three acres were grown in the field. Field and greenhouse production was 70,000 tubers.

Greenhouse production was started from tissue culture plantlets. A total of 18,000 tissue cultured plantlets produced approximately 40,000 tubers. Of these, approximately 15,000 will be planted in the field in 1988 and the remainder will be sold to seed producers and industry representatives.

The tissue culture plantlets were tested for Bacterial Ring Rot, Blackleg and fungal wilt organisms. Greenhouse plants were tested for Potato Virus X, Potato Virus S, Potato Spindle Tuber Viroid and Potato Leaf Roll Virus. All field grown plants were tested for Potato Virus X and Potato Virus S. All plants were visually inspected for signs of other diseases. Except for an occasional Potato Leaf Roll or Rhizoctonia infected plant, none of these diseases were detected in our seed stocks.

Because of the potential risk of diseases being spread by insects, insecticides are used on a regular basis in the greenhouse and field. Both field and greenhouse plants are monitored for insects.

VEGETABLE PROGRAM

Program Leader: P. Ragan
Technologists: T. Maruno, M. Briant

OBJECTIVES

The Vegetable Program serves the fresh and processing sectors of a growing vegetable industry through applied field research and industry extension activities. The fresh vegetable industry in Alberta consists of both commercial (wholesale) and market garden producers plus processing growers that provide vegetables for the canning and freezing industry. Research activities emphasize cultivar evaluation and earliness enhancement of crops through improvements in cultural management. An extension role through on-farm visits and participation in commodity organizations/activities serve to educate and strengthen members of the industry.

RESEARCH PROJECTS

CULTIVAR EVALUATION

There were 850 cultivars representing 18 different crops on trial. Treatments consisted of comparisons between direct seed and transplant, early spring and late spring seedings, plus successive seeding regimes of select cultivars. Many of the entries, particularly among processing crops, represent advanced breeding lines from Europe and the United States. Final evaluation of storage crops such as carrots, cabbage and cooking onions included a 6 month storage quality assessment.

Details of results pertaining to cultivars tested are reported in ASCHRC Pamphlet 88-5.

CULTURAL TRIALS

Detailed results of cultural trials and discussion of results are reported in ASCHRC Pamphlet 88-4.

Plant Population.

Several trials studied the effects of plant populations on maturity and yield of processing crops.

A wax bean population density trial indicated that as the number of plants per hectare increased from 110,000 to 545,000 (45,000 to 225,000 per acre) yield increased although there was reduced pod set on each plant. Processing corn in a similar trial yielded fewer cobs per plant and overall yield decreased with increased plant density in the row beyond 6 plants/metre. Poorer tip fill, smaller cob diameter and shallower kernel depth were characteristic of high plant populations. Precision drilling of processing carrots indicated that seed drops varying from 60 to 150 per metre of row failed to influence overall yield, however, at the low range of seed drop a larger, easier to process root size was produced.

Succession Seeding.

Numerous trials on successive seedings on 10 day intervals produced results of value to both processors and fresh market producers. Processing corn quality and yield was generally the highest with early spring seedings and heat unit requirements decreased as seeding was delayed. Carrots seeded over six 10-day intervals produced more Canada #1-sized roots if sown in mid to late May when harvested 125 days after sowing. Seedings after May produced a drop in yield. The prime cropping period for succession-sown broccoli was from late-April to early-May and late July to early August. The reduced incidence of hollow stem was directly related to a decline in available nitrogen as the season advanced. Fresh-market radishes sown over an 11 week period were generally free of environmental influences on quality and yield, however, radish seed did not mature. Bunching onions successively sown at 10-day intervals produced shorter tops as seeding was delayed. Yield from May to June seedings produced the highest yields. The cultivar, Kincho, proved to be superior in all aspects to Hardy White Bunching.

Onion Production and Applied Rates of Phosphorus.

The cooking onion cultivar, Improved Autumn Spice, was treated to three levels of phosphorus fertilizer in order to observe the effects this nutrient might have on maturity and yield of the crop.

Prior to seeding, 0, 336 and 672 kg/ha (0, 300 and 600 lb/ac) of 0-45-0 were applied to 18 sq. m plots in a randomized complete block design. Raw seed was sown April 21 with a Stanhay precision drill equipped with 72-72 X #11 hole size smooth rubber belts on A pulley.

No significant response to phosphorus treatments was recorded, however, one trend was evident. Maturity appeared to occur earlier with the addition of phosphorus. Yield response was unpredictable as measured in both graded yield and total yield (t/ha). Individual bulb weight also failed to respond to phosphorus and perhaps the soil reserve of 156 lb/ac was more than sufficient to sustain yield.

Frost Protector Evaluation.

Commercial products that enhance growth or protect young plants from frost injury were evaluated on peppers under field conditions. Each product was applied according to manufacturer's specifications. Products and treatments tested included:

1. titantent (P15) - opaque wire reinforced cover
2. clear plastic row cover with black plastic mulch (BPM)
3. protecta-cap (jumbo) on black plastic mulch (BPM)
4. protecta-cap (jumbo) - a corrigated plastic cover with top vents
5. wall o'water - a water filled poly tube

On May 20 a -6°C temperature was recorded and all plants under the row cover treatment were frozen. Variable spot damage occurred in all other treatments except the wall o'water. As the season progressed vegetative growth appeared normal, however, all fruit continued to be

deformed and greatly reduced in size. The growth check persisted right through the summer.

Despite no record of statistical yield significance, both protecta-cap treatments produced highest first harvest yields, however, by season end the titantent treatment produced the highest season total yield and number of marketable fruit.

On the June 22 date only the titantent and protecta-cap treatments produced fruit yields that were positively correlated to vegetative growth. Inclusion of black plastic mulch with the protecta-cap produced a significant negative correlation. The significantly higher vegetative growth early in the season under the wall o'water treatment failed to correlate positively to fruit yield. By the July 18 date the added vegetative growth in all treatments failed to positively increase fruit yield, but rather a significant negative yield relationship existed in protecta-cap (BPM) and wall o'water treatments.

Highest minimum temperature differences were recorded under the wall o'water with maximum temperature differences to ambient air lowest under the protecta-cap. The wall o'water maintained the warmest and most stable temperature over the 24 hour period. All treatments maintained a higher temperature than ambient air with only the wall o'water maintaining an above freezing temperature between hours 1 and 7.

Winter (Fall) Vs Spring Seeding.

For many years research staff at the Alberta Special Crops and Horticultural Research Center in Brooks have investigated the possibilities of seeding some field grown vegetables at the onset of winter. The concept was developed with the hope that such a practice would lead to early access to markets the following season.

Initially, all crops were tested and it was soon evident that only crops with a high degree of frost tolerance were successful. The following crops are recommended with no specific varietal recommendations since there appears to be little varietal advantage.

Crop	Maturity Advantage When Winter Sown
spinach	10 days earlier to optimum development
lettuce, all types	2 to 3 weeks earlier to maturity
onions (cooking)	2 weeks earlier to 50% tops down
carrots	earlier sizing
parsnips	earlier sizing

Actual time of seeding is critical as soil temperature at seeding depth must be at 5°C or colder. In southern Alberta this generally occurs in late October. Visual signs such as ice persisting throughout the day on ponds and frost evident at mid-day in shade of buildings helps to indicate that soil temperature is ideal for seeding. The grower is advised to prepare the seedbed well in advance of seeding and do the actual seeding as late as possible. The success of winter seeding depends mostly on soil temperature at the time of seeding. The seed must lie dormant in the soil where free water for uptake is not available before

freeze-up. Imbibition of water by the seed before freeze-up will destroy viability when ice forms in the seed. It should be noted that the soil cools off very slowly and a few warm days do little to increase soil temperature. Many growers get unnecessarily concerned over brief warm spells that occur throughout the winter.

Soil condition of the seedbed is important. Heavy clay soils have a tendency of crusting and a thick crust can reduce seedling emergence. Choosing a lighter, more sandy soil texture has its advantages, however, some form of wind protection is advised. In southern Alberta, a few commercial growers have succeeded in holding the soil down by deep cultivation of furrows creating lumps and ridges.

Over many differing winter weather conditions, the viability of seed can vary and generally the more snow cover the better for the seed. Table 1 indicates the percentage of seed that survives from the recommended seed drop.

Table 1. Recommended seeding rates and germination of spring and winter seeded vegetables

Crop	Recommended Seed Drop per 30 cm		Germination Percent	
	Spring	Winter	Spring	Winter
Spinach	20	30	80-90	50-60
Lettuce	10	15	60-70	30-40
Onions (cooking)	18	30	70-80	40-50
Carrots	40	60	60-70	25-40
Parsnips	15	25	70-80	25-35

All trials involved raw seed that was sown with a Stanhay precision drill. Current research trials are using coated seed.

The resulting loss in seed viability with winter seeding necessitates the need for increased seed drop. The requirement can prove to be costly particularly when hybrid seed is used. As a result growers are encouraged to use less costly seed and increase the seed drop to attain a good plant stand and yield.

Aside from the reduced plant stand with winter seeding, some physiological disadvantages occur with a crop that experiences temperatures well below freezing early in the seedling stage. Carrots may bolt, onions may produce multiple growing points and lettuce may fail to head properly. The incidence of such physiological disorders is rare and is directly related to the duration and severity of low temperature exposure. A temperature of -8°C or greater appears to be critical.

EXTENSION AND SERVICE ACTIVITIES

Several services are available to vegetable producers including use of specialized equipment, precision seeder belt cutting and seeder calibration. Extension services in the past year have included production

courses, on-farm demonstrations and producer consultation. Many cooperative research and extension projects were conducted with seed companies, plant breeders, producer organizations and government personnel.

FRUIT CROPS PROGRAM

Program Leader: L. Hausher
Technologist: P. Pih

OBJECTIVES

The Fruit Crop Program serves the berry and small fruit industry in Alberta through applied research and extension activities. Strawberries, raspberries, and saskatoons are emphasized, although other fruit crops are being evaluated for commercial potential. Extension and developmental work is done with producers and producer organizations.

RESEARCH PROJECTS

Details on cultivar evaluation and cultural trials are reported in ASCHRC Pamphlet 88-6, 1987 Fruit Crop Trials.

A mild winter and early spring resulted in early bloom and fruit set of bush and tree fruits. A -6°C frost lasting approximately eight hours on the night of May 19 resulted in destruction of forming fruit of tree fruits, saskatoons, cherries, and black currants.

STRAWBERRIES

Evaluation of Junebearing Strawberry Cultivars for Yield and Winter Hardiness.

Nine cultivars of strawberries were established in 1983 in two identical blocks. One block was protected during the winter with straw mulch, the other had no protection.

Cultivars which were covered with winter straw mulch had increased yield, berry size and winter survival over non-mulched treatments. The cultivar Kent had an acceptable yield when mulched. The cultivars Veegen, Veeglow, Badgerbelle, and Veestar do not appear to have sufficient hardiness or yield potential to be commercially viable under southern Alberta conditions. Since commercial producers generally only harvest three seasons, this trial was maintained to establish fourth-year picking information. The yields of all cultivars was dramatically lower than the previous year.

A new replicated cultivar trial was established in 1987. Sixteen cultivars and seven advanced selections were planted for yield and hardiness evaluation.

Evaluation of Day Neutral Strawberry Cultivars for Yield and Quality.

Nine cultivars were established in two single-row blocks. One block was covered with a clear, perforated, polyethylene tunnel for six weeks. Plants were de-blossomed and de-runnered in the early season to enhance establishment. Total and marketable yields were recorded until October 6. The cultivars Hecker and Tristar had the highest yields of quality berries. The use of the tunnel enhanced production only marginally. Tristar received the best culinary score when the fruit was evaluated after freezing.

A similar study at the Alberta Tree Nursery and Horticulture Center, Edmonton, resulted in similar findings although all yields were much lower than Brooks. Tristar had the highest yields.

RASPBERRIES

From 1981 to 1986, 27 cultivars and 51 seedlings were evaluated for yield, quality, and hardiness characteristics. Based on results from these trials, 13 cultivars and 10 seedlings were selected and re-established in a replicated trial in 1987.

In 1987 the cultivar 'Festival' significantly outyielded other cultivars.

OTHER BUSH FRUITS

Gooseberries

Five cultivars and three selections of gooseberries were evaluated for yield potential and fruiting characteristics. The cultivars 'Pixwell' and 'Parkside' were the top producers. Four years of evaluations resulted in 'Pixwell' and 'Parkside' having the best average production; however, no one cultivar was consistent in production from year to year.

This trial will be terminated.

Red Currants

Five cultivars of red currants were evaluated for yield potential and fruiting characteristics. After five years of evaluation the cultivar 'Red Cross' produced the highest average yield, and was the most consistent producer.

ORNAMENTALS PROGRAM

Program Leader: Vacant
Technologist: Nigel Seymour

OBJECTIVES

The Ornamentals Program provides research, extension, and service for Alberta's nursery industry. Ornamental propagation and production research is conducted and both herbaceous and woody plant material is evaluated for hardiness and horticultural qualities.

The Golden Prairie Arboretum is maintained as a service for both the public and nursery trades industry.

RESEARCH PROJECTS

WOODY ORNAMENTALS

Prairie Regional Trial for Woody Ornamentals.

This co-operative trial was initiated under the auspices of the Western Canadian Society for Horticulture to evaluate hardiness and ornamental value of woody ornamentals, and is now conducted at ten sites on the prairies. Since initiation, 716 entries have been tested for a five-year period and recommendations made to the nursery industry.

There were 19 entries from the Agriculture Canada Research Station at Mordon, Manitoba, planted in 1982 that were evaluated in 1987. Thirteen were recommended for general planting, two were unsatisfactory, and three did not survive the trial period.

The more outstanding plants were: Cornus alba 'Sibirica Variegata'; and Forsythia x 'Northern Gold'; Lonicera x 'Miniglobe'.

No entries were received in 1987.

Hardiness and Evaluation Trial for Woody Ornamentals.

Twelve additional entries were received from commercial nurseries in 1982. Lawyer Nurseries, Plains, Montana, donated eight species, all of which were lost. Coaldale Nurseries donated three, Betula populifolia and Malus 'Jan Kuperus' are recommended while Prunus Armeniaca mandshurica is worth trying in Alberta. McHugh Nurseries, Eltopia, Washington, donated Euonymus alata 'Compacta' which is recommended.

In 1987 five entries were received for hardiness testing from Morden, two from the University of Saskatchewan, one from Eagle Lake Nursery, one grown from seed from the Devonian Botanic Garden and eleven roses from Massot Nurseries, Vancouver.

Regional Woody Plant Test Program.

This co-operative trial between the Landscape Alberta Nursery Trades Association and Alberta Agriculture commenced in 1983. Evaluations are conducted at ASCHRC and nurseries in southern Alberta. In 1987, an additional 24 entries were planted in ASCHRC bringing the total to 127 entries; 16 entries were planted at Foothills Nursery, Calgary, bringing the total to 122 entries; and 24 were planted at Coaldale Nursery, Coaldale, bringing their total to 114. ASCHRC staff plant and take records of the three southern sites while staff at the Alberta Tree Nursery and Horticulture Centre, Edmonton, co-ordinate the trial and supervise four other sites in northern Alberta.

Further information on this trial is available from the Director of the Alberta Tree Nursery and Horticulture Centre, Edmonton.

Forest Genetics Trial.

This ongoing trial is maintained for the Alberta Forest Service, which is co-operating with Proctor and Gamble Cellulose Ltd., Grande Prairie, to test the effect of latitude changes on growth rates and time-to-flowering of several tree species. Presently, there are grafted white spruce clones, seedling white spruce strains, and seedling tamarack, Englemann spruce, black spruce, lodgepole pine, Raivola larch, and Siberian larch on trial.

Rose Cultivar Evaluation and Overwintering Trials.

The ASCHRC maintains a collection of shrub and tea roses for the public to view in an accessible rose garden. Data from this trial are used to recommend rose cultivars to nurseries, garden centers, and to the public through the Horticulture Guide.

During the winters of 1985-86 and 1986-87 several methods of winter protection of roses were evaluated. Results from the first year indicated that leaf mulch provided better protection than the thermal blanket, or peat moss. Because of the high mortality of all four cultivars in all treatments no specific conclusions can be made from the second year's results.

NURSERY PRODUCTION

Propagation Trial.

The second year of a trial designed to determine the best time to take softwood cuttings for rooting was completed in 1987. Cuttings were taken every week for 12 weeks from 20 different species of woody ornamentals starting on May 28. The rooting success of each species on each date was recorded. Flowering dates of other ornamental species were recorded so that cutting recommendations could be based on flowering dates of specific plant rather than calendar dates.

Container Overwintering Trial.

Several species of containerized plants were grown in three soil mixes and protected during the winter by four methods, including two treatments where nominal heating was applied to the soil under the containers. All treatments resulted in good winter survival. The treatments with underground heating broke dormancy early, resulting in early growth and shoot elongation. All treatments were damaged by the severe May 19 frost.

Fertigation of Container-Grown Plants.

Seven species of ornamentals were grown in three media and fertilized with three concentrations of 20-20-20 fertilizer (100, 200, and 300 ppm) to evaluate the effects on plant growth and mortality. Shoot length, spread, dry shoot weight, and dry root weight were recorded. Data were not analysed for this report.

ANNUAL AND PERENNIAL FLOWERS

The Center again participated in the All-America annual flower trials and evaluated annual flowers from six major flower seed companies. Further information on these trials is available by requesting ASCHRC Pamphlet 88-2

Annual Flower Trials - 1987.

ASCHRC maintained its extensive collection of over 600 cultivars of gladioli in 1987. The collection will be dispersed in the spring of 1988, and approximately 75 cultivars will be retained every year for evaluation.

SERVICE PROJECTS

Golden Prairie Arboretum.

Since 1981 over 500 cultivars of woody ornamentals have been established in the Golden Prairie Arboretum. The arboretum is open to the public at all times and the specimens are all labeled with common name, scientific name, and their hardiness is indicated by color-coded labels. This is the largest single collection of ornamentals in Prairie Canada and serves the public and the nursery industry of Alberta.

GREENHOUSE CROPS PROGRAM

Program Leader: Vacant
Technologist: Murray Briant

OBJECTIVES

The greenhouse crops program at ASCHRC serves Alberta's greenhouse industry by evaluating new greenhouse technologies such as production systems and cultivars. Crop production information, diagnosis of crop disorders, and interpretation of tissue and soil test reports is normally provided by the greenhouse specialist.

RESEARCH PROJECTS

VEGETABLE CROPS

Production of Cucumbers on Rockwool.

This project was established to evaluate cultivars grown on rockwool and to compare new rockwool slabs with those that had been used for one year. The cucumbers were seeded on January 6, 1987 and harvested until August 31, 1987. There were no apparent differences in yield between the new and used rockwool slabs. The cultivars Farbio, Salvador, and Profito had the highest yields.

Production of Tomatoes on Rockwool.

This project was established to evaluate four cultivars grown on new and used rockwool slabs. The tomatoes were seeded on two dates, October 3, 1986 and November 3, 1986. There were no apparent differences in yield of tomatoes harvested from the new and used rockwool slabs. The tomatoes seeded in October were first harvested on January 9 and had an average yield 17 percent greater than those planted on November 3 which were first harvested on February 11. The cultivars Dombito, Laura, and Caruso had comparable yields; however Counter produced less total yield because of the small fruit size.

Production of Peppers on Rockwool.

To evaluate rockwool for pepper production four cultivars of indeterminate green bell peppers were seeded on October 10, 1986 and planted into rockwool slabs on January 7, 1987. Two pruning methods were also evaluated for their effects on yield and fruit size: all fruit were left at each node and fruit were left at every other node. The peppers were harvested from March 13 until October 1, 1987. All cultivars had the highest yields from the treatments where fruit were left at each node. Bruinsma Wonder had the highest yield and highest mean fruit size.

Hydroponic Lettuce Production.

Four cultivars of lettuce were seeded on three dates to evaluate their production in a hydroponic trough system. They were seeded on

December 1, 1986 and January 6 and February 24, 1987. They were planted on January 27, February 12, and March 26, respectively. Paris Island Cos produced good yields and had good quality with little or no tipburn or bolting. Mean head size of Paris Island Cos from the first two harvests was 207 g.

ORNAMENTAL CROPS

Alstroemeria Production.

Ten cultivars of alstroemeria established in 1986 were harvested from December 1986 until November 1987. For the second year, Jacqueline, a pink-flowered cultivar, had the highest yield at 73.6 stems per plant. Vanitas (red) produced 60.4 stems per plant and Ontario (pink) produced 60.4 stems.

Timing of Pinching of 10-cm Pot Chrysanthemums.

A study in cooperation with F.H. Rabb Greenhouse Ltd. of Strathmore was conducted from May to September 1987 to determine the effects of timing of pinching on quality and production of 10-cm potted chrysanthemums. Data were not analysed for this report.

SPECIAL CROPS AND AGRONOMY SECTION

This section has facilities and technical resources to conduct applied research, extension, and development services on special crops such as pulse crops, field corn, mustard, sunflower, and other new crops. The section is also responsible for cereal and oilseed cultivar testing and forage evaluation. Water management of crops and the relationship of irrigation and soil management to crop productivity are also researched by this section. Cultivar evaluation and management studies (including intensive crop management) are major emphases of the section. Research and extension projects are conducted co-operatively with numerous other agencies.

Section Administration and Special Crops Section

Refe Gaudiel, B.S.A., M.Sc., Ph.D. ... Section Head & Research Agronomist
Collin Wildschut, Dipl. Hort. ..... Technologist
Pat Moskaluk ..... Secretary

Field Crops

Henry Najda, B.Sc., M.Sc., P.Ag. ..... Research Agronomist

Soil and Water

R. Colin McKenzie, B.S.A., M.Sc., Ph.D., P.Ag. ..... Research Agronomist
Neil Clark ..... Technologist

SPECIAL CROPS PROGRAM

Program Leader: R. Gaudiel
Technologist: C. Wildschut
Seasonal Technologist: M. Braithwaite

OBJECTIVES

The Special Crops Program is responsible for applied research, extension, and development work on alternate and new crops for Alberta. The program also provides service to other departmental staff and commodity organizations as resource specialists and through co-operative tests and in demonstration plots.

A detailed report of research projects involving pulse and other special crops will be published in the ASCHRC pamphlet series in 1988.

RESEARCH PROJECTS

EVALUATION OF CULTIVARS AND CULTURAL PRACTICES FOR DRYBEAN PRODUCTION

Drybean Cultivar Trials.

Fifteen tests (screening, observational, and advanced yield) were conducted at Brooks, Bow Island, and Standard to evaluate drybean cultivars, selections, and breeding lines for yield, maturity, and other agronomic characteristics. Several selections of black drybeans were tall, erect, and somewhat early. A few pinto entries were early in maturity and bushy in growth habit. One of the promising "architype" (tall, erect, narrow plants) lines from Michigan State University tested last year continued to perform well. In addition, several new breeding lines of navy and small white beans received from private companies and public institutions were both early and tall enough for direct harvest and high density seeding. Evaluation of the promising lines and selections will continue in 1988.

Cultural Trials of Drybeans.

Two fertilizer experiments to determine the effects of applying varying rates of nitrogen and phosphorus on yield of drybeans were each conducted at Lethbridge and Enchant. In addition, sulfur, potassium, and certain micronutrients were added to selected plots to determine yield responses to these nutrient elements. Grain yield was not increased by the addition of the different fertilizers except at Enchant with nitrogen fertilization of 40 kg/ha. The effectiveness of commercial foliar sprays containing nitrogen, phosphorus, potassium, and micronutrients was evaluated at Bow Island and Brooks. There were no visual differences among treatments.

Trials, especially on "architype" varieties of drybeans, were conducted at Bow Island and Brooks to determine optimum row spacing and population. Preliminary data indicated that yield can be increased by closer spacing and higher population. A study at Brooks on seeding date of late-maturing varieties showed that May 20 is an optimum seeding date. Results of a co-operative study with M. Kaldy of Agriculture Canada Research Station, Lethbridge, on the canning quality of small white beans, showed that beans grown in Alberta tended to stick together and matted more than similar varieties of beans grown in Ontario.

EVALUATION OF CULTIVARS AND CULTURAL PRACTICES FOR THE PRODUCTION OF NEW CROPS

Evaluation of Cultivars and Cultural practices for the production of Pulse Crops.

Cultivars and breeding lines of fieldpeas, lentils, fababeans, soybeans, lathyrus, and lupins were evaluated at Brooks, Bow Island, Acadia Valley, and Standard. The plots at Standard were abandoned because of poor emergence and stand. Most of the wrinkled-type (processing) peas were early, determinate in growth habit, and had a short flowering period. Pea varieties that are early-maturing, semi-leafless, and erect growing

are suited for the more moist, cooler areas of central and northern Alberta. At Enchant the yield of fieldpeas increased with increasing rates of nitrogen up to 60 kg/ha. The application of the other nutrient elements did not increase yield.

Tests of lentil cultivars grown on dryland at Acadia Valley and Brooks were abandoned because of poor emergence and stand. No new outstanding fababean line was observed in the co-operative test. Fababean lines with white, low tannin seed coats, from Agriculture Canada at Lacombe, were early to mature and might have some potential for central Alberta. Selected broadbean plants were evaluated and enough seed was increased for preliminary yield test planting in 1988. All soybean entries matured but emergence and plant stand at Bow Island were uneven. Lathyrus lines with a low neuro-toxic factor were evaluated at Brooks under irrigated and dryland conditions. Lathyrus appeared to grow better than other pulse crops under dryland conditions. Several selections of white lupin and one variety of yellow lupin did not mature before the killing frost. Drought stress appears to be necessary to induce plants to mature.

Evaluation of Cultivars and Cultural practices for the Production of Other New Crops.

Cultivars and lines of safflower, mustard, canary seed and hybrids of sunflower were evaluated at Brooks, Bow Island, Taber, and Acadia Valley. A few safflower lines that were selected for higher oil content were as early and yielded as well as the standard cultivar, Saffire. No new mustard line was outstanding compared with the standard cultivar. The canary seed variety Elias did not yield as well under dryland but was comparable in yield under irrigation with the standard cultivars. There were a few new lines of canary seed that were comparable in yield with the standard cultivar.

The confectionery sunflower hybrid test at Brooks was abandoned because of wildlife damage. The sunflower hybrids, Interstate 8004, Sigco 974, and Dahlgren 141, produced higher yields and more large seed than the standard hybrids under both dryland and irrigated conditions. Under dryland conditions at Taber, four oilseed hybrids were high yielding.

Several trials were conducted at Brooks, Bow Island, and Taber to determine the effects of plant population, seeding rates and dates on yield and other agronomic characteristics of sunflower and safflower. In addition, studies were conducted on desiccation and irrigation of safflower at Brooks and Lethbridge, and fertilization trials with sunflowers at Enchant. Sunflowers that were planted in early May matured early and produced higher yields. Different plant populations within the range of 30,000-75,000/ha did not greatly affect the yields of irrigated or dryland sunflowers, however, plant population affected the percentage of large seeds produced. The higher the plant population, the lower the percentage of large seeds produced. An increase of 15,000 plants/ha resulted in an average of 9-10% reduction in large seeds for the large-seeded hybrid Sigco 954, and 15-20% for the small-seeded hybrid Seedtec 043. A premium is paid for large seeds (>20/64). The sunflower fertilizer test at Lethbridge was not harvested because of bird damage.

At Enchant, there was no significant increase in yield due to fertilizer treatments.

The safflower trials at Brooks suffered uneven emergence and stand because of the dry spring weather. Generally, earlier seeding resulted in higher yields and earlier maturity. Yields of safflower were not greatly affected by lower populations because of the plants' ability to compensate for the extra space. Providing sufficient soil moisture until the bloom stage appeared to be adequate for producing high yields. It was difficult to evaluate the effects of desiccants on seed moisture because of variability in plant maturity.

HERB AND SPICE ADAPTABILITY AND CULTURAL PROJECT

An observation and demonstration plot was established and maintained for extension and display purposes. A fenugreek cultivar trial with three selections was conducted at Brooks. The selection, NC 109-1, gave the highest yield, though, all the fenugreek selections were late to mature. Drought stress appears to be necessary to induce fenugreek to reach maturity before the first killing frost. Assistance was given to a farmer in Carmangay to establish a test field of ½-1 ha each of several herbs for essential oil extraction. The herbs grown were: monarda, anise, oregano, summer savory, hyssop, fennel, and sweet marjoram. Because of late seeding, only fennel was tall enough for machine harvesting by the time of the first frost. Proper seeding procedure and weed control measures were found to be very important in the establishment and production of these crops. More trials on these crops are planned for 1988.

CORN AND SORGHUM CULTIVAR AND CULTURAL PROJECT

Field Corn and Sorghum Hybrid Trials.

Grain and silage corn hybrid tests were conducted both at Bow Island and Brooks. Results from these sites were combined with results from two other sites in southern Alberta (Lethbridge and Medicine Hat) to help support recommendation of hybrids for registration and in making recommendations to farmers. Approximately 40 grain and 50 silage hybrids were included in the tests. Emergence was uneven at both sites. Although the frost on May 19 and 20 killed the plant tops, plants recovered and continued to grow normally, however, maturity was delayed by the spring frost and the cool, moist weather of August. Most of the hybrids reached maturity because of the lateness of the first killing fall frost (October 5) which resulted in above-normal accumulation of corn heat units for the season. Several promising experimental hybrids yielded as well as the standard hybrids and were earlier to mature. Consistent early maturity of these hybrids would allow the consistent production of good quality corn and could expand the area of corn production in Alberta.

Several sorghum hybrids received from seed companies were evaluated at Brooks and Bow Island. Plant stand at Bow Island was uneven and sparse because of herbicide damage. Results from these tests will be used to support application for registration.

Cultural trials of Field Corn.

Grain and silage corn at Lethbridge and Enchant were fertilized with varying rates of nitrogen and phosphorus to gather soil test calibration data. This trial is in co-operation with R. H. McKenzie of Alberta Agriculture Soils Branch at Lethbridge. In both grain and silage corn tests at Enchant, there were no significant differences on yields among fertilizer treatments. At Lethbridge, similar results were obtained except that nitrogen fertilization up to rates as high as 80 kg/ha increased the yield of silage corn. Data obtained in 1987 is being combined with data obtained in previous years to formulate fertilizer recommendations based upon results of soil analyses. A test to determine the effects of plant population on hybrids differing in maturity was abandoned because of bird damage.

The Effect of Water Regimes on Growth Pattern of Perennial Crops.

Plots of alfalfa, bromegrass, and crested wheatgrass established in 1984 were irrigated with different amounts of water to relate the effects of soil moisture levels on the growth and development pattern of forage crops. The plots were harvested weekly from the time there was enough growth for sampling early in spring to the time the plants were in full bloom. This project is in co-operation with Dr. I. S. Selirio and is funded by the Alberta Hail and Crop Insurance Corporation at Lacombe. This is the last year of evaluation; analyses and organization of results is underway.

FIELD CROPS PROGRAM

Program Leader: H. G. Najda
Seasonal Technologist: A. Middleton

OBJECTIVES

In the Field Crops Program research is conducted on cereals, oilseeds, and forage crops to provide up-to-date information for the producer.

Over 90 trials are conducted at various locations in southern Alberta. The main testing site is located at McLeod Farm at ASCHRC; other sites are located at Standard, Acadia Valley, and Bow Island.

The dry spring of 1987 was responsible for delayed and uneven emergence of crops. August was colder and wetter than normal and this delayed maturity from one to two weeks in many of the cereals and oilseeds. The majority of harvesting was completed during September, which was an ideal month with warm drying temperatures.

RESEARCH PROJECTS

CEREAL AND OILSEED CULTIVAR EVALUATION

Cereal and Oilseed Regional Tests.

ASCHRC, the Field Crops Branch of Alberta Agriculture, Agriculture Canada Research Stations at Beaverlodge, Lacombe, and Lethbridge, and the University of Alberta, co-operate in regional testing of all recommended varieties, new varieties, and breeding lines of hard red spring wheat, durum wheat, utility wheat, barley, oats, triticale, flax, and canola. Three irrigated sites (Brooks, Bow Island and Standard) and one dryland site (Acadia Valley) in southern Alberta are part of this regional testing and are established, maintained, and harvested by the ASCHRC. Information from these trials, which cover over 30 sites province-wide, was used by the Cereal and Oilseed Advisory Committee in formulating and revising the Alberta Agriculture recommendation factsheet entitled Varieties of Cereal and Oilseed Crops for Alberta - 1988. Because of the rapid release of new cultivars and the trend toward cultivars with local, regional, or specific adaptation, the importance of this program has increased.

Other Cereal Projects.

The Field Crops Program assists the Field Crops Branch of Alberta Agriculture, Lacombe, with their breeding program on 2-row and 6-row barley, semi-dwarf barley, triticale, winter triticale, and winter wheat. The progeny and advanced line tests provide agronomic data that are used in the selection process for determining new varieties that are suitable for irrigated areas.

In co-operation with the Expert Committee on Grain Breeding, trials are conducted on triticale for use as grain and silage as part of a nationwide testing program of this cereal crop.

ANNUAL FORAGE CROP STUDIES

Silage Trials.

In 1987, studies were initiated to evaluate the silage performance of two- and six-row barleys, oats, utility wheat, triticale, field pea, fababean, and forage sorghum varieties. The trials include registered as well as potential varieties for use in Alberta. These trials will provide an extensive data base on variety performance to use in making recommendations to producers.

Cultural Studies.

Previous studies have indicated that several annual crops could be used effectively to supply adequate forage either as pasture, silage, or hay throughout the season. Double cropping and intercropping spring and winter cereals for hay, silage, and fall pasture use are being investigated in co-operation with V. Baron of Agriculture Canada, Lacombe, and D. Salmon of Alberta Agriculture, Lacombe with funding from Farming for the Future. First-year data has shown that when barley, usually

considered a single harvest crop, is harvested at the early jointing stage, it can produce two to three forage cuts a year. This project will continue for 2 more years.

Studies continue on seeding rate ratios of spring and winter cereals to determine the ratio that is best in producing hay or silage and pasture in a double-cropping management system.

Forage Brassica Trials.

Forage brassicas can extend the grazing season by serving as a high-yielding, palatable, late-fall pasture. Annual trials to evaluate the cultivar performance of brassicas such as fodder turnip, forage kale, and forage rape were continued.

PERENNIAL FORAGE CROP STUDIES

Longevity of Perennial Forages Trial.

Perennial forage plots established in 1981 and 1982 at Brooks and Standard were harvested in 1986 and 1987 to determine the longevity and yield of different cultivars of various forage species including alfalfa, bromegrass, timothy, orchard grass, reed canary grass, crested wheatgrass and Russian wild rye. These sites have had only minimum inputs (i.e. no weed control, no fertilizer) over the last 3 to 4 years and 1988 will be the last year of evaluation. During 1986 and 1987, the alfalfa cultivars maintained a relative performance to each other when compared with earlier data. Analyses for some of the grasses such as crested wheatgrass and Russian wild rye were inconclusive because of the high variability in the tests that might have masked significant differences in yield between the cultivars.

Perennial Forage Seed Production.

New trials were initiated this year to investigate the possibility of producing forage grass seed economically under irrigation. Although there has been very little research on this subject in Alberta, there are some southern Alberta farmers who have been successful in growing forage grass seed under irrigation over the past few years.

A meadow foxtail cultivar trial in co-operation with Agriculture Canada, Beaverlodge, a meadow bromegrass cultivar trial with Agriculture Canada, Saskatoon, and a reed canary grass cultivar trial were initiated. These grasses were chosen for study because of their market potential for use in environmental reclamation and pasture.

A forage cut was taken to determine the economic benefits of harvesting hay in the establishment year from a stand of grass grown for seed production. Mowing (clipping) the field in the establishment year and removing the forage is a standard management practice to decrease the possibility of insect or disease problems. The first harvest to measure seed yields will be in 1988.

SOIL AND WATER AGRONOMY

Program Leader: R. C. McKenzie
Technologist: N. F. Clark

This unit was transferred in 1987 from the Irrigation and Conservation Division at Brooks to the ASCHRC to provide research and extension on soil and water concerns of special and horticultural crops. Research has involved water use and nutritional problems of crops and their tolerance to salinity. Research projects conducted in 1987 included completion of a number of projects carried over from the Irrigation and Conservation Division. L. H. Andruchow, Supervisor of Crop Economics, Production and Resource Economics, Alberta Agriculture, Edmonton, is assisting with economic analysis of moisture and fertility changes under fallow and stubble. W. Chomistek organized data and prepared reports on the calibration of the EM38 salinity meter and the tolerance of wheat and kochia to salinity.

RESEARCH PROJECTS

Irrigation of Lentils.

Two lentil cultivars, Eston (small seeded, early maturing) and Laird (large seeded, late maturing), were grown under four levels of irrigation varying from 25 to 200 mm. The yield of both lentil cultivars was highest at the lowest level of irrigation and declined appreciably with additional increments of water.

Irrigation of Safflower.

Two cultivars of safflower (Saffire and S208) were grown under four levels of irrigation varying from 25 to 272 mm. Saffire yielded well under all but the first level of irrigation and showed reduced yields in the lowest level of irrigation. Yields of S208 declined with the highest two rates of irrigation. It is most probable the reduced yield of S208 at the higher rates of irrigation was due to increased disease incidence under increasing amounts of moisture.

Salinity Tolerance of Kochia.

Kochia first appeared in Western Canada as a weed about 1950. It grows well in a variety of conditions including saline areas. Studies in Saskatchewan and the U.S.A. have indicated that it is useful as a forage crop. Samples were taken for yield from a series of locations in four fields of kochia in southern Alberta. From this data, a preliminary relationship on the tolerance of kochia to various levels of soil salinity was determined.

Moisture and Fertility Changes Under Fallow and Stubble.

From 1984 until 1987, data were collected semi-annually on soil moisture and on nitrate and ammonium nitrogen from 5 to 9 sites in the Peace River and Central Alberta Regions to quantify the benefits of fallow on the subsequent crop. Preliminary data indicate that nitrogen

mineralized during the fallow period is more important to the subsequent crop than moisture stored during the fallow year. A detailed economic analysis is being conducted by L. Andruchow of the Production Economics Branch of Alberta Agriculture.

Monitoring Changes in Salinity in Levelled Land.

Two sites were monitored in 1987 to determine changes in soil salinity over time on cut areas of levelled land. Data collected will be compared with that of previous years, before land levelling, to determine changes which have occurred subsequent to land levelling.

Winter Wheat Production on Standing Stubble in East Central Alberta.

Winter wheat has traditionally been grown on summer fallow in southern Alberta and on stubble in Central and Northern Saskatchewan but is seldom grown on stubble in a similar climatic area in East Central Alberta. New and better varieties of winter wheat with improved winter hardiness and improved drills for direct seeding into untilled stubble provide an opportunity to expand the traditional winter wheat area. The stubble traps snow and prevents winter kill. These techniques for production of winter wheat were developed at the University of Saskatchewan.

Producing winter wheat on stubble in Alberta will reduce the dependence on fallow which contributes to soil erosion, loss of soil organic matter, and formation of soil salinity.

In 1987, two Farming For the Future, On-Farm Demonstration sites were harvested and a similar set of plots were planted for the 1988 crop. The sites were located at Iddesleigh and Kirremuir. The treatments consisted of: planting on tilled and untilled stubble; three rates of nitrogen applied in the spring and one rate applied in the fall; seeding with a hoe and a disc drill, provided by Vicon Can. Ltd., and three rates of seeding. At Iddesleigh, in 1986 and 1987, winter wheat was seeded on two dates.

The crop had good winter survival at both sites. At Kirremuir, in 1987, all treatments yielded less than 1 t/ha due to below normal winter snow and lack of spring rain in May and June. At Iddesleigh, the crop seeded on untilled stubble yielded from 1.5-2 t/ha and the crop seeded on tilled stubble yielded less than 1 t/ha.

Calibration of EM38 Salinity Meter Readings to Saturated Paste Extract Values for Soils having Different Texture, Temperature, and Moisture Conditions.

The EM38 electromagnetic inductance meter is an instrument used for rapid, in-the-field measurement of salinity without taking a soil sample. The saturated paste extract is the internationally recognized method for measuring soil salinity but requires approximately 30 minutes of labour to collect and analyze a sample. A set of calibration curves has been developed for EM38 readings based on over 700 determinations, with an 80% accuracy to that of the saturated paste extract values.

G. Travis of the PFRA, Hanna, has developed a program for a data logger which can be used to record readings of the EM38. In 1987, with a data logger and an EM38 on a small sled pulled behind a garden tractor, 50 readings per hectare or 20 readings an acre were recorded, and the data collected for a salinity map of the ASCHRC. The cost of collecting information using the conventional saturated paste method would be about $2000/ha as compared with about $20/ha with the data logger and an EM38.

A PORTABLE METER AND COMPUTER BEING USED TO COLLECT AND RECORD SOIL SALINITY DATA.

CROP PROTECTION AND UTILIZATION SECTION

This section conducts research, extension, and service programs in plant pathology, entomology, weed control, post-harvest physiology, food processing and quality evaluation, and plant diagnostics. Support is provided to production programs at ASCHRC and to agricultural industries and individual producers, both amateur and commercial, in Alberta. Crop pest surveys, diagnoses of disease, insect, and weed problems, pesticide efficacy testing, evaluation of storage practices, and food product development are examples of some of the work carried out by section staff. Research and extension projects are done co-operatively with other ASCHRC staff and federal/provincial research agencies. Close working contacts are maintained with commercial commodity and scientific organizations in Alberta and beyond.

Section Administration and Plant Pathology

Ronald J. Howard, B.S.A., M.Sc., Ph.D., P.Ag... ..... Section Head and Plant Pathologist
Karen Chapman ..... Section Secretary
Edward Moskaluk ..... Laboratory Technician

Post-Harvest Program

Vacant ..... Post-Harvest Specialist/ Plant Pathologist

Food Processing & Quality Evaluation

Nancy Crowe, B.Sc. (Ag.), M.Sc. ..... Food Scientist
Margaret Dench ..... Laboratory Technician
Joseph Hung,.B.Sc..... Laboratory Technician

Weed Control

Rudolph Esau, B.S.A., M.Sc., P.Ag. ..... Weed Control Specialist
Vacant ..... Technologist

Regional Crop Laboratory

David Kaminski, B.S.A., M.P.M. ..... Diagnostician
Steven Slopek, B.Sc., M.P.M. ..... Diagnostician
(Contract employee through Olds College)

Entomology

Arthur Tellier, Dipl. Hort. ..... Technologist

Entomology - Crop Protection Branch

Jim Jones, M.Sc. ..... Entomologist

Leader: R. Howard
Technician: E. Moskaluk
Seasonal Technician: T. Allen

OBJECTIVES

The Plant Pathology Program has a mandate to conduct applied research on important diseases of specialty crops, fruits, greenhouse crops, interior plants, and selected cereal, oilseed, and forage crops. These studies encompass field, laboratory and greenhouse experiments, as well as disease surveys. Findings from this work and from the research of other scientists are presented to producers through extension. Service is a third activity which primarily involves consultative backup to the Regional Crop Laboratories at Brooks and Olds. Some plant pathology projects are also discussed in the reports of the Post-Harvest and Regional Crop Laboratory (Olds) Programs.

RESEARCH PROJECTS

DISEASES OF SPECIAL CROPS

Evaluation of Fungicides and Application Methods for the Control of White Mold on Dry Peas.

No fungicides are presently registered in Canada for the control of white mold (Sclerotinia sclerotiorum) on field peas. To obtain efficacy data, benomyl (Benlate) and iprodione (Rovral) fungicides were evaluated against the disease on 'Venus' peas. The fungicides were applied as single and double treatments using equipment which simulated aerial and ground application methods. By August, white mold infestation was extensive in all subplots. At harvest, no significant seed yield differences were observed between the various fungicide treatments, or between any of them and the untreated control, for either application regime. Considerable yield variability was encountered between replicates which increased the ANOVA error term and thus resulted in relatively low F values. This may have affected the ability to detect real differences between treatments. One trend which emerged from the data was that the 'ground' method of applying the fungicides appeared to result in higher pea yields than the 'aerial' method. Details of this trial were reported in the 1987 Pesticide Research Report of the Expert Committee for Pesticide Use in Agriculture, Agriculture Canada, Ottawa.

Evaluation of Processing Pea Cultivars for Root Rot Resistance.

Resistance is an important means of controlling several pea diseases. To determine if certain commercial cultivars and experimental lines were resistant to root rot, fourteen selections (provided by D. Fauth, Empress Foods Ltd., Taber) were planted in non-replicated blocks in a commercial field north of Vauxhall. The field was naturally infested with Fusarium spp. and other root-rotting fungi. At maturity, plant samples were taken from plots of Scout, Bolero, Vulcan, H680, Dual and Challis. The

remaining cultivars were not sampled because they were inadvertently plowed down before they had matured. The six cultivars harvested matured within 70 days of planting. Vulcan yielded the best, followed by Challis, Bolero, Dual, H680 and Scout, respectively. Scout had the lowest incidence of root rot, followed by Vulcan, H680, Dual, Bolero and Challis. Scout also had the lowest root rot severity rating, while Bolero and Challis had the highest.

Effect of Row Spacing and Seeding Rate on the Susceptibility of Architype Dry Beans to Sclerotinia White Mold.

The use of architype (erect-growing) cultivars and high density planting techniques are two new trends in dry bean production in North America. To evaluate their effect on bean yield and disease occurrence under Alberta conditions, five architype dry bean lines (N84004, C-20, C-38, NA80024, and 61745E) and Seafarer, a bush bean, were seeded in a field plot naturally infested with Sclerotinia sclerotiorum at ASCHRC. The following row spacing/seeding rate regimes were approximated: 70 cm / 250,000 plants / ha (standard), 35 cm / 250,000 plants / ha (narrow row, standard rate), and 35 cm / 500,000 plants / ha (high density). White mold incidence (% plants infected) was determined for the three regimes in each cultivar subplot as the plants neared maturity. Although there was a trend towards more disease in the high density versus standard treatments, it was only statistically significant with 61745E. Similarly, yields tended to be comparatively higher in the high density plots, but only with C-38, NA80024 and 61745E was this trend significant. This was a cooperative trial work with R. Gaudiel and C. Wildschut, ASCHRC.

DISEASES OF FORAGE CROPS

Thermal Inactivation of Verticillium albo-atrum in Infected Alfalfa Stems.

Verticillium albo-atrum, the incitant of Verticillium wilt of alfalfa, was found to survive up to one hour of exposure at 85°C in air-dried alfalfa stems (1985 AHRC Annual Report). This helped to explain why the fungus was able to persist in infected alfalfa during the commercial cubing process (1983 and 1984 AHRC Annual Reports). The thermal inactivation study was repeated in 1987 to corroborate the 1985 results and to enable the testing of fresh, infected material. Fresh and air-dried stems infected with V. albo-atrum were exposed for varying times to temperatures from 20 to 85°C in 5° increments. At 20°C, the fungus was recovered from stems even after 52 weeks of exposure. Survival times declined proportionally with increasing temperature. At 40°C and less, the duration of survival in dry and fresh stems was identical; however, at >45°C, the fungus was recovered more often from the dry stems. Pathogenicity of the recovered isolates remained intact, even in the high temperature, long-duration treatments.

Efficacy of Fungicides Against Powdery Mildew of Cissus rhombifolia.

Powdery mildew (Oidium sp.) is a common disease of oak-leaf ivy. To determine which commercial fungicides might provide effective control, benomyl (Benlate), dinocap (Karathane), dodemorph-acetate (Meltatox), triforine (Funginex), copper oxychloride (Microcop-50), and sulphur (Micro-Niasul) were evaluated. They were applied as foliar sprays to the leaves of young oak-leaf ivy cuttings. After the fungicides had dried, powdery mildew spores were dusted onto the foliage. When mildew ratings were made four weeks later, all products tested, except Microcop-50, provided significant mildew control relative to the water check. Overall, Karathane and Funginex were the most effective.

Evaluation of the Phytotoxicity and Visible Residues of Fungicides Applied to the Foliage of Cissus rhombifolia.

It is essential that fungicides applied to foliage plants be non-phytotoxic and leave minimal visible residues on the leaves. The same fungicides used in the mildew trial described above were evaluated on grape and oak-leaf ivy foliage for residues and phytotoxicity. Aqueous solutions of each product were applied three times. Visible residues were assessed after each application, and phytotoxicity ratings were done one week after the final application. Only slight phytotoxicity symptoms were visible on the plants. Microcop-50 and Micro-Niasul caused the greatest amount of injury on both species of Cissus. Microcop-50 left heavy, undesirable residues on the leaves of both ivies at all application rates. Micro-Niasul- and Benlate-treated plants had slight to moderate amounts of residue, while the other products left negligible deposits. Microcop-50 and Micro-Niasul would not be considered commercially acceptable products for use on grape and oak-leaf ivy because of phytotoxicity and residue problems.

Removal of Fungicide Residues from the Foliage of Cissus rhombifolia.

Pesticide residues on the leaves of tropical foliage plants detract from their appearance and their removal may become necessary. In a trial at ASCHRC, oxalic acid, acetic acid, insecticidal soap, dishwashing detergent, a commercial leaf shine compound, and tap water were tested for their ability to remove residues of benomyl (Benlate) and copper oxychloride (Microcop-50) from the leaves of grape and oak-leaf ivies. The fungicides were applied and allowed to dry before the residue removal chemicals, at various concentrations, were sprayed onto the leaves to runoff. Benlate-treated plants sprayed with Later's Leaf Shine appeared the best; however, this effect was mostly due to the ability of the product to cover up rather than remove the residues. Ivory Liquid, vinegar and Safer's Insecticidal Soap removed some of the Benlate deposits, but usually not any more effectively than tap water. Oxalic acid at all concentrations made the Benlate-treated plants look worse than the untreated control. On the plants with Microcop-50 residues, the use of Later's Leaf Shine, vinegar and Safer's Soap all resulted in a significant improvement in plant appearance, but insufficient amounts of residue were removed to make the plants acceptable for retail sale. The

difficulty of removing residues of fungicides such as Microcop-50 from the leaves of foliage plants may preclude their use in commercial greenhouses and interiorscapes.

Evaluation of the Phytotoxicity of Soil-Applied Fungicides on Cissus rhombifolia.

Pathogenic fungi such as Pythium and Rhizoctonia may attack and kill rooted cuttings of various interior plant species, therefore, fungicide drenches are frequently applied following transplanting. If used in excess, however, fungicides can themselves be harmful to the plants. To evaluate the risk of phytotoxicity, seven common soil-applied fungicides [metalaxyl (Apron), etridiazole (Truban), iprodione (Rovral), pentachloronitrobenzene (Quintozene), oxine benzoate (No Damp) and carbathiin + captan (Vitavax-Captan)] were applied at various concentrations to grape and oak-leaf ivy cuttings. Some of the plants treated with Apron and Truban showed slight signs of chlorosis of the new leaves at five times the label rate. No apparent phytotoxic effects were visible on the plants treated with the remaining chemicals. The phytotoxicity of the seven products tested was not significant enough to preclude their further evaluation as soil drenches for root rot control on C. rhombifolia.

Details of all interior plant disease trials were reported in the 1987 Pesticide Research Report of the Expert Committee for Pesticide Use in Agriculture, Agriculture Canada, Ottawa.

DISEASES OF FRUIT CROPS

Efficacy and Phytotoxicity of Fungicides on Saskatoons.

Saskatoons are subject to attack by a number of fungal diseases which may reduce fruit yields and tree longevity. At present, there are no fungicides registered on this crop in Canada. In 1987, field trials were carried out at Brooks and Beaverlodge, in cooperation with J. Davidson, Agriculture Canada, to gather efficacy data. Benomyl (Benlate), thiophanate- methyl (Easout), and triforine (Funginex) were evaluated for their ability to control brown rot (Monilinia amelanchieris) and rust (Gymnosporangium spp.) in an orchard of 'Smoky' saskatoons at ASCHRC. The chemicals were applied as foliar sprays at, and following, flowering. Visual observations of disease incidence were made during the growing season and berry yields were determined from the treated plants. No apparent phytotoxic effects were visible on any of the treated bushes. Environmental conditions were not favorable for brown rot development and none was found on the berries in any of the treatments, including the control. None of the fungicides significantly affected the average numbers of berries per cluster relative to the check. As well, no significant control of rust was provided by any of the products tested. Details of this study were reported in the 1987 Pesticide Research Report of the Expert Committee for Pesticide Use in Agriculture, Agriculture Canada, Ottawa.

DISEASE SURVEYS

Blackleg of Canola. Twenty-six canola fields in Census Divisions 2, 3, 5 and 6 were surveyed for blackleg (Leptosphaeria maculans). The virulent strain of the fungus was not found; however, the mildly virulent strain was detected in several fields.

Verticillium Wilt of Alfalfa. Seventy alfalfa fields in Census Divisions 2 and 5 were surveyed. The disease was found in three fields in Division 2 and three fields in Division 5. All fields with the disease were irrigated hay. Wilt was not found in any seed fields in the County of Newell.

EXTENSION AND SERVICE ACTIVITIES

ASCHRC Plant Pathology staff spoke at several growers' meetings, workshops, and short courses. They also made regular contributions to the ASCHRC Crop Protection Newsletter. In addition, several miscellaneous publications were prepared. Liaison was maintained with district agriculturists in Region I and the southern part of Region II. Staff were also active in several professional societies and advisory committees. Diagnostic assistance was provided to the ASCHRC and Olds Regional Crop Laboratories.

POST-HARVEST PROGRAM

Leaders: R.J. Howard and K.I. Mallett
Technologists: E.R. Moskaluk and G.A. Smith

OBJECTIVES

The Post-Harvest Program includes research, extension and service in post-harvest physiology and plant pathology. Plant pathology responsibilities encompass potatoes, vegetables, trees, turf, and ornamentals. Extension is done for commodity groups, individual growers, and commercial mushroom producers. Current research projects are reported below. The service component of this program aids the ASCHRC Regional Crop Laboratory and the Prairie Potato Breeding Program headed by Dr. D. Lynch, Agriculture Canada Research Station, Lethbridge.

PLANT PATHOLOGY RESEARCH PROJECTS

DISEASES OF POTATOES

Screening Potato Seedlings for Resistance to Early Blight.

Twenty-one seedlings from the Prairie Potato Breeding Program and two licensed cultivars (Russet Burbank and Warba) were planted in an infested

field at ASCHRC and assessed for resistance to early blight (Alternaria solani). Disease incidence (% plants infected) was 100% in all lines and overall severity (intensity of infection) was moderate. Twelve lines were rated moderately to highly susceptible to early blight (similar to Warba), while 11 lines had intermediate resistance (similar to Russet Burbank). None was highly resistant to the disease.

Screening Potato Seedlings for Resistance to Rhizoctonia Canker.

Eight potato cultivars provided by D. Lynch were planted in an infested field at ASCHRC and assessed for resistance to Rhizoctonia canker (Rhizoctonia solani). Canker incidence was almost 100% in all lines, indicating a uniform susceptibility of the material under test. As the plants neared maturity, canker severity was measured on stem samples from each cultivar and the relative susceptibility ranking was determined to be: Atlantic < Sangre < Norchip < Norland = Shepody = Conestoga < Superior < Russet Burbank.

Establishing a Nursery to Screen Potato Seedlings for Resistance to Fusarium and Verticillium Wilts.

A susceptible cultivar, Norchip, was planted into a plot area artificially infested with the wilt fungus, Fusarium oxysporum, to determine the uniformity of pathogen distribution. Observations of plant symptoms during the growing season indicated a low disease incidence. Stem samples were taken from the plots as the potatoes neared maturity and assessed for Fusarium infection. Only 20% had symptoms of vascular discoloration. Levels of soil-borne inoculum will have to be increased from 1987 levels before meaningful screening trials can be carried out.

Cut seed pieces of 'Norchip' and 'Russet Burbank' were dipped in a spore suspension of Verticillium dahliae and planted in a field at ASCHRC. During the growing season, the plants were observed for symptoms of Verticillium wilt, and stem samples taken from the plot in September were assayed for the fungus. Very few plants and stems exhibited wilt symptoms, indicating that the inoculation technique was unsuccessful. Other inoculation methods will be evaluated in 1988.

DISEASES OF TURFGRASS

In Vitro Efficacy of Fungicides Against Marasmius oreades.

Triforine (Funginex), oxycarboxin (Plantvax), hexaconazole (PP523) and flutolanil (Moncut) were added to malt agar in concentrations ranging from 0 to 500 ug/L. Three isolates of the fairy ring fungus, Marasmius oreades, were inoculated onto the plates and the extent of radial growth was measured after 10 days. All of the fungicides reduced the growth rate of the fungus in direct proportion to their concentration, but none completely prevented growth. The relative efficacy of the products was hexaconazole > flutolanil > oxycarboxin > triforine.

Evaluation of Fungicides for the Control of Fairy Rings in Lawns.

No fungicides are presently registered for the control of the fairy ring disease (Marasmius oreades) in turf. To obtain efficacy data which might lead to the registration of an effective product, hexaconazole and flutolanil were mixed with water and a soil wetting agent and applied to fairy rings at ASCHRC. The plots were observed throughout the summer for phytotoxicity symptoms, and for the presence of mushrooms and stimulated grass growth which would indicate that the fungus was active. Hexaconazole caused a slight wilting of the grass after treatment, but the grass recovered after 2-3 weeks. Both fungicides completely suppressed mushroom formation.

POST-HARVEST PHYSIOLOGY RESEARCH PROJECTS

HANDLING AND STORAGE OF POTATOES

Evaluation of Ellehammer Bags for Control of Potato Greening.

Tubers of 'Norland', 'Russet Burbank' and a white-skinned seedling were placed in paper, clear plastic, and Ellehammer plastic bags and exposed to continuous fluorescent light at 67 ft c for 7 days. The objective of this trial was to determine if Ellehammer bags, which are intended to exclude ultraviolet light, would reduce potato greening. At the conclusion of the trial, the chlorophyll content of the tubers in each type of bag was measured with a Hunter Color Difference Meter. Although the Ellehammer bags did not completely prevent greening, the chlorophyll levels were 1½ times less than those of tubers stored in clear plastic. Potatoes stored in paper bags had 2½ times less chlorophyll than those in clear plastic. This was a co-operative trial with T. Smyrl, ASCHRC.

Bioactivity of Metalaxyl Fungicide in 'Norland' Potatoes.

Metalaxyl fungicide applied to the foliage of potatoes has been found to reduce storage decay caused by various fungi. The objective of this study was to determine if foliar-applied metalaxyl would reduce Fusarium dry rot in potatoes. Ridomil MZ (metalaxyl + mancozeb) was sprayed onto the foliage of 'Norland' potatoes in a plot at ASCHRC. Some was also applied as a soil drench. The tubers were harvested, stored for two to five months, then inoculated with Fusarium sambucinum and F. culmorum to bioassay for metalaxyl activity. The tubers were examined for dry rot six weeks after inoculation. The foliar treatment reduced dry rot in tubers that had been stored for four months, but not in those stored for two or five months. The drench treatment reduced dry rot significantly more than the foliar treatment. Tests for polyphenoloxidase activity, an indirect measure of metalaxyl activity in the tubers, proved inconclusive.

HANDLING AND STORAGE OF VEGETABLES

Storage of Winter Squash.

'Table King' (acorn), 'Kindred' (buttercup), 'Baby Hubbard' (hubbard), and 'Vegetable Spagetti' squashes grown at the ASCHRC were heat cured and then stored at 10 ± 4°C with a relative humidity of 60 ± 5% for

235 days. At the conclusion of the trial, the fruits were examined for decay and weighed to determine the amount of loss since harvest. Table King lost the most weight, followed by Baby Hubbard, Kindred and Vegetable Spagetti. Vegetable Spagetti had the highest percentage of marketable fruit, followed by Kindred and Baby Hubbard. No Table King squashes were considered suitable for sale after 235 days of storage. This was a co-operative trial with P. Ragan, ASCHRC.

MUSHROOM RESEARCH PROJECTS

EXOTIC MUSHROOM PRODUCTION

Outdoor Culture of the Oyster Mushroom.

Commercial production of oyster mushrooms (*Pleurotus* spp.) is a recent innovation in Alberta. Present methods involve growing the fungus indoors on substrates such as straw. In the People's Republic of China, oyster mushrooms are commonly grown outdoors. To evaluate this technique under Alberta conditions, five strains of *Pleurotus* were selected for field production trials at Brooks and Vegreville, in cooperation with S. Davies and L. Junshan, Alberta Environmental Centre. Spawn was mixed into a sawdust/bran substrate in plastic-covered ground beds in the spring of 1987. At the Brooks location, the fungi had colonized the substrate, and by late summer the covers were removed and replaced with a perforated plastic tunnel with a built-in misting system. Successive harvests were taken from the *P. ostreatus* 'Florida', *P. ostreatus* 'Hybrid', and *P. sajor-caju* beds, but not from *P. citrinopileatus* or *P. ostreatus* '284'. Although some strains yielded several kg of mushrooms/ bed, their culinary quality was rated fair to poor. Very few mushrooms were produced outdoors at Vegreville, presumably because of the cooler temperatures which prevailed during the summer.

SERVICE ACTIVITIES

Program staff assisted D. Lynch, Potato Breeder, Lethbridge Research Station, with pathogen indexing and field roguing of potato lines. Various potato trials conducted by the ASCHRC Potato Program were inspected for disease during the growing season. Two out of 21 potato samples were diagnosed positive for bacterial ring rot (BRR) during the annual inspection of commercial fields in Alberta. The scope of the survey in 1987 was limited compared to past years. Previously, all commercial potato plantings over one acre in size were examined for BRR. In 1987, only those farms which had had a history of BRR within the past five years were inspected. Assistance was provided to the ASCHRC Diagnostician and other Center staff in diagnosing diseased potato, vegetable, tree, ornamental and turf samples.

EXTENSION ACTIVITIES

Post-Harvest staff provided extension information to growers and agricultural professionals in the following areas: storage of vegetable and nursery crops, diseases of potatoes, vegetables, trees, turf and ornamentals, and commercial mushroom production. Regular contributions were made to the ASCHRC Crop Protection Newsletter. K. Mallett was Chairman of the Alberta Dutch Elm Disease Action Committee.

FOOD PROCESSING AND QUALITY EVALUATION PROGRAM

Leader: N. Crowe
Technicians: M. Dench and J. Hung

OBJECTIVES

The Food Processing and Quality Evaluation Program has three major areas of responsibility: to undertake research relevant to Alberta horticultural and special crops, to provide extension to processors of horticultural crops, and to perform chemical and sensory analysis as requested by other ASCHRC research programs, processors, and growers.

The amount of research carried out by this Program was severely restricted in 1987 by the nine-month period during which the Program was without a Program Leader. Plans are underway to re-activate a number of projects as well as to develop new areas of research.

RESEARCH PROJECTS

FRUIT CROPS

Saskatoon Fruit Leather.

Nine saskatoon cultivars (Forestburg, Honeywood, Moonlake, Northline, Parkhill, Regent, Smoky, Success, Thiessen) were evaluated for use in fruit leather production. A formulation consisting solely of saskatoon berries, honey, and acidulant, was prepared and dried in a domestic food dehydrator. The leather was evaluated for appearance, flavor, color, and texture by trained panelists. All of the cultivars tested exhibited the potential to produce an acceptable fruit leather. Leathers prepared using Success and Parkhill were ranked highest for flavor and overall acceptability. While some of the panelists identified the presence of seeds in the leather as being objectionable, this problem appeared to be less obvious when cultivars with smaller seeds were used. This work will continue in 1988.

Physical Characteristics of Saskatoon Berries.

The 1986 crop of saskatoons had been evaluated, on a cultivar basis, for such characteristics as number of seeds/berry, size of seeds, and wt seeds/100 g berries. Crop failure due to frost thwarted plans to repeat this in 1987. As conditions allow, this work will continue in 1988.

Chemical Characteristics of Chokecherries and Mongolian Cherries Grown in the Peace River Region.

The moisture, vitamin C, pH and sugar contents of numerous varieties of chokecherries and Mongolian cherries were measured. This work was done in co-operation with J. Davidson (Agriculture Canada Research Station, Beaverlodge). The chemical analyses were used in evaluating varieties for their commercial suitability.

Analysis of Saskatoon Juices and Syrups.

A variety of saskatoon samples and other fruit were subjected to gas chromatographic head space analysis to identify and compare major volatile flavor components. Initial tests indicated that incubation of juice samples at 75°C was optimum for the head space analysis. A study of sample size and dilution effect revealed that 0.75 mL gave optimum resolution and quantitation of components. The juice from crushed saskatoons had a higher proportion of low molecular weight components than did juice from processed (heat treated) saskatoon samples. Commercial saskatoon syrups and strawberries had no volatile flavor components in common. Similarities were observed between saskatoon juices and almond extract; this was due to the presence of benzaldehyde in both of these samples.

VEGETABLE CROPS

Evaluation of an Alternate Method for Measuring Cabbage and Carrot Color.

At the present time, laborious extraction and quantitation methods are used to measure the color of cabbage and carrots (chlorophyll and carotene, respectively). This study assessed whether a rapid technique based on spectral reflectance (Hunter Lab Colorimeter) could be used in place of labor-intensive chemical methods. Corresponding chemical and spectral data were analyzed by linear regression. There was no significant relationship between Hunter Lab colorimeter readings and carotene content of carrots. On the other hand, there was significant correlation between the colorimeter readings and chlorophyll content of cabbage. As a result, the spectral reflectance technique is currently being used to follow cabbage color during storage. Not only is this method more rapid, but being non-destructive, identical cabbage leaves can be evaluated over the entire storage period thereby eliminating some sample variation.

EXTENSION AND SERVICE ACTIVITIES

A variety of extension activities were carried out in 1987. These included problem solving in processing plants, providing technical expertise in the repair and calibration of laboratory instruments, and the development of analytical methodology for a number of local processors. In addition, a variety of technical information was supplied to District Home Economists, marketing groups, and the general public, as requested. As the need arose, loans of small laboratory equipment were made. Contact and cooperation with the Food Processing Centre at Leduc were maintained.

The chemical and sensory evaluation laboratories continued to provide a number of analyses to ASCHRC programs as well as processors and growers. Chemical analyses provided included reducing sugars, individual sugars (glucose, fructose, sucrose), carotene, chlorophyll, ascorbic acid, pH, moisture, and glycoalkaloids. The sensory laboratory froze, pickled, deep fried, boiled, and baked a wide range of produce. After appropriate storage periods, the samples were evaluated and scored by panelists for appearance, flavor, texture, and overall acceptability. Other samples, e.g., potato chips, were objectively evaluated with the Agtron meter.

WEED CONTROL PROGRAM

Leader: R. Esau
Technologist: Vacant

OBJECTIVES

The major objectives of the Weed Control Program are: to improve existing weed control practices for vegetables, potatoes, nursery, fruit, and special crops by evaluating commercial and experimental herbicides; to assist staff at the ASCHRC Regional Crop Laboratory with the diagnoses of herbicide injury to crops and identification of plant specimens; and to provide weed control information to commercial and amateur growers. Further details of all research trials appear in the 1987 Research Report of the Expert Committee on Weeds (Western Canada).

RESEARCH PROJECTS

WEED CONTROL IN VEGETABLE CROPS PROJECT

Onions - High priority was placed on evaluating bromoxynil (Torch) for weed control in onions. Onions treated with bromoxynil were sampled periodically for residue analysis (Minor Use Pesticide Program). To evaluate tolerance, a second trial was conducted where bromoxynil was applied at three rates to onions at three different growth stages.

Peas - Cyanazine (Bladex) was tested alone or as a tank mix with MCPA-Na for control of broadleaved weeds in peas. While these treatments did not affect yields, metribuzin (Lexone/Sencor), included for comparison, provided the best weed control. Samples were collected for residue analysis by CIBA-Geigy. Work with cyanazine on peas has been completed.

Cabbage - Napropamide (Devrinol) was tested in flowable and wettable powder formulations, each at two rates. It was also tested in combination with other herbicides. One of the most effective treatments was a tank mixture of trifluralin (Treflan) and napropamide (incorporated prior to seeding).

Squash - Herbicide usage did not improve squash yields when the crop was grown with clear plastic mulch. Squash grown without plastic mulch showed a significant yield decrease in herbicide-treated plots compared with the hand weeded control.

WEED CONTROL IN SMALL AND NATIVE FRUITS PROJECT

Three trials were conducted in the Peace River region with technical assistance by S. Kitt, Fruit Growers' Society of Alberta. In established saskatoons at Sexsmith, shoot growth was not affected by any of the five herbicidal treatments applied in May, 1986, nor by dichlobenil (Casoron 4G) applied only in October, 1986. Dandelions were most effectively controlled by oxyfluorfen (Goal) at 2 kg/ha, dichlobenil at 4.5 kg/ha, and linuron (Afolan/Lorox) at 4 kg/ha and linuron + paraquat (Gramoxone) at

4 + 0.75 kg/ha; control was still acceptable for most of these treatments in October, 1987. Grasses were not effectively controlled by any of the herbicides tested.

The quackgrass trial was continued; two applications of haloxyfop-methyl (Verdict) (0.25 + 0.25 kg/ha), applied about six weeks apart, and glyphosate (Roundup) at 1 kg/ha applied before saskatoon bud break, were the best treatments. These treatments show potential for quackgrass control, however, future work should include chemical control supplemented by cultural methods.

A trial, with saskatoons planted in 1986 and which included preplant incorporated and pre-emergence treatments, was evaluated in 1987 for efficacy and crop injury. Linuron (Afolan/Lorox) activity persisted until August, 1987 as evidenced by the control of dandelions. No crop injury was observed.

CONTROL OF GRASSES IN HORTICULTURAL CROPS

Graminicides (herbicides which specifically control grasses) were evaluated on a variety of horticultural crops, namely, potatoes, cucumbers, and processing peas. These trials were organized within several projects. Crops did not show any symptoms of phytotoxicity, however, DPX-Y6202 (Assure), accidentally applied at ten times the recommended rate, injured the foliage of peas and cucumbers. The use of ammonium sulphate (high grade liquid fertilizer) enhanced the effectiveness of sethoxydim (Poast) and RE45601 (Select).

These tests were conducted to generate efficacy and crop tolerance data which is required for registration. Unfortunately, rutabagas and carrots, in a proposed graminicide trial, had to be disked down due to severe infestation of broadleaved weeds. This work will be continued in 1988.

WEED CONTROL IN POTATOES

One trial was conducted to evaluate sethoxydim (Poast) plus metribuzin (Sencor, Lexone) to assess possible interactions for reduction of grass control. Unfortunately, due to an error in application, this evaluation was not possible. Bentazon (Basagran) alone and in mixture with sethoxydim was also tested. The direction of this project will be reviewed for 1988.

WEED CONTROL IN PULSE CROPS

One trial with 17 treatments was aimed at both broad spectrum weed control and the specific control of wild tomato (Solanum triflorum Nutt.) in dry beans. This trial was conducted in cooperation with Agriculture Canada, Lethbridge, where work was specifically directed at controlling hairy nightshade (Solanum sarachoides Sendt.). Nightshade infestations have become more widespread recently and this is of major concern to bean growers.

Weed populations were low and wild tomato did not occur in the plots. AC263,499 (Pursuit) at 150 and 300 g/ha caused unacceptable crop injury. Only the latter treatment reduced yields significantly in comparison with the hand weeded check. Seed weights (1000 seeds) were not affected by any of the herbicidal treatments. This project will be continued.

WEED CONTROL IN NURSERY CROPS

Weed control trials on container stock of spirea, juniper and alpine currant were conducted to evaluate crop tolerance and efficacy. Granular formulations of trifluralin (Treflan), napropamide (Devrinol) and oxadiazon (Ronstar) were each applied at two rates. Napropamide stunted the growth of all three species in this test, whereas the other two herbicides did not. Napropamide and oxadiazon provided nearly complete control of common groundsel. This work will be repeated to further assess the phytotoxicity of these products.

Herbicide demonstrations were conducted at Bowden and Coaldale. At the former site, none of the herbicides tested injured Manitoba maple, Villosa lilac, and chokecherry. At Coaldale, green ash was unaffected by the herbicidal treatments, however, the weed control results were highly variable.

HERBICIDE PERSISTENCE STUDIES

Chlorsulfuron (Glean) trials established in 1982 and 1984 were recropped to potatoes, canola, lentils, and alfalfa in 1987. The 1981 test site was discontinued and the 1982 site will not be recropped in 1988.

A 1986 trial with AC263,499 (Pursuit) on dry beans was recropped with canola. AC263,499 applied at three rates from 30 to 150 g/ha caused unacceptable crop injury to canola in the following year.

Dicamba (Banvel) was applied alone and in combination with 2,4-D ester for control of early spring weeds; these treatments were evaluated in lentils and 'Fielder' wheat. Lentils were totally destroyed by dicamba and 2,4-D treatments applied before seeding. Wheat was severely set back by the dicamba treatments, but yields were not significantly reduced.

EXTENSION AND SERVICE ACTIVITIES

A weed tour was held on July 28 for weed research and extension personnel (25 people attended). At the ASCHRC Potato Field Day, the participants viewed and discussed the weed control trials. Extension information related to weed control was provided to growers by telephone, and in letters and through presentations at meetings.

The roller applicator was loaned to 11 growers to selectively control Canada thistle and other tall weeds in alfalfa and bean crops.

REGIONAL CROP LABORATORY PROGRAM[1]

Leaders: R. Howard and M. Dykstra
Seasonal Technician: C. Krause

The southern Alberta Regional Crop Laboratory (RCL) experienced a reduction in the total number of plant disease, insect, and plant identification specimens in 1987. Only 1209 specimens were received, down 39% from the previous year.

The summaries which follow, and which were detailed in the February '88 issue [Vol. 12(2)] of the ASCHRC Crop Protection Newsletter, were made possible through a computer software system, developed by the Center. The system uses dBase III Plus and is capable of retrieving individual forms and of summarizing all forms for a prescribed item of interest and time period, e.g., all the instances of root rot on greenhouse tomatoes during the period of May - August, 1987.

Table 2. Summary of plant disease specimens received (January 1 - December 31, 1987).

Category	Number of Specimens	Percent of Total	Percent Commercial
Woody Ornamental	227	29	20
Vegetable Crop	145	18	68
Interior Plant	116	15	66
Greenhouse Crop	76	10	79
Herbaceous Ornamental	61	8	34
Cereal	59	7	98
Fruit	49	6	18
Miscellaneous	27	3	30
Special Crop	13	2	100
Forage	11	1	91
Oilseed	9	1	78
TOTAL	793	100	51

[1]This report was prepared by D. Kaminski

Table 3. Summary of insect specimens received (January 1 - December 31, 1987).

Category	Number of Specimens	Percent of Total	Percent Commercial
Woody Ornamental	134	47	15
Household Pest	46	16	4
Interior Plant	19	7	16
Cereal	16	6	94
Vegetable Crop	16	6	38
Miscellaneous	16	6	50
Greenhouse Crop	13	4	85
Herbaceous Ornamental	10	3	10
Fruit	9	3	0
Forage	3	1	100
Oilseed	2	1	100
Special Crop	0	0	0
TOTAL	284	100	25

Table 4. Summary of plant identification specimens received (January 1 - December 31, 1987).

Habitat	Number of Specimens[1]	Percent of Total	Percent Commercial
Park/Yard/Garden	52	39	13
Annual Crops	17	13	94
Pasture	16	12	81
Miscellaneous	14	11	57
Fallow	9	7	100
Water Course/Slough	9	7	89
Waste Area	7	5	71
Forage Crop	6	5	100
Brush/Forest Land	2	1	50
TOTAL	132	100	55

[1]Of all the plant specimens identified in the lab, 14 were classified as restricted, noxious, or nuisance weeds under the Alberta Weed Control Act (1979).

Phone inquiries were handled by the Center's Information Officer. The total number of calls, 5851, was up considerably (34%) from the previous year.

REGIONAL CROP LABORATORY PROGRAM - OLDS

Leader: S. Slopek
Seasonal Technician: S. Peters

OBJECTIVES

The Regional Crop Laboratory (RCL), Olds, provides diagnostic and extension services, and conducts applied field research and pest surveys. Weed, insect and plant disease diagnostics are performed. Extension and applied research activities are primarily directed towards field crop diseases.

DIAGNOSTIC REPORT

Between January 1 and December 31, 1987, the RCL received 620 submissions: 300 disease, 173 entomology and 147 unidentified plant specimens. Approximately 20 percent were from commercial operations. The number of specimens handled was slightly higher than in the past few years.

Rove beetles were a common household problem in the early months of 1987. The most commonly submitted weeds were perennial smartweed, American dragonhead and rogue oats. Many ornamentals suffered leaf scorch during the dry period in May and June. Glume blotch and blackpoint were the most common cereal diseases. Numerous domestic vegetable specimens with herbicide damage were also received.

Dry conditions early in the season were unfavourable for cereal crops, however, the relative humidity was sufficiently high to allow several fungi, such as Septoria, Alternari and Erysiphe species, to develop. By the end of the season, Alternaria black spot caused heavy yield losses in some fields of canola. Heavy yield losses also occurred in fields of 'Diamond' barley in the Crossfield area. Yield loss was the result of blighted heads, however, it was not possible to identify the exact cause; a number of fungal species may have been involved, including Septoria spp., Cochliobolus sativus, Fusarium spp., Alternaria spp., and barley thrips.

RESEARCH PROJECTS

DISEASES OF CEREAL CROPS

Seed Treatment Evaluation for Loose Smut Control in Galt Barley, 1987.

This trial was conducted under the leadership of D. Orr, Agriculture Canada, Lacombe. Duplicate trials were planted in Lacombe, Olds, Beaverlodge and Vegreville. All chemicals and combinations tested had significantly less smut than the untreated check at all locations. The most effective treatments at all locations were a combination of PP 450 plus EL 228, UBI 2454, and a mixture of UBI 2466 plus EL 228. They resulted in a mean, over all locations, of only two to three infected

heads per 2 m of row. Detailed results of these fields were reported in the 1987 Pesticide Research Report of the Expert Committee for Pesticide Use in Agriculture, Agriculture Canada, Ottawa.

Seed Treatment Evaluation for Common Root Rot Control in Galt Barley, 1987.

This trial was also conducted under the leadership of D. Orr, with duplicate trials planted in Lacombe, Olds and Vegreville. Individual lots of barley seed were treated with twelve fungicides to evaluate their efficacy against common root rot (Cochliobolus sativus and Fusarium spp.). There were no significant differences in emergence at any location, indicating a lack of phytotoxicity in the chemicals tested. Only at Lacombe and Vegreville were there significant differences in common root rot ratings. The following three treatments showed significantly less disease than the check at both sites: UBI 2100-2 plus EL 228, HWG 1608 plus EL 228, and PP 450 plus EL 228. There was no consistent yield increase reflecting significant disease control. Detailed results of this trial were reported in the 1987 Pesticide Research Report of the Expert Committee for Pesticide Use in Agriculture, Agriculture Canada, Ottawa.

Foliar Fungicide Evaluation for Leaf Diseases Control in Harrington Barley.

Six fungicides (Spotless, Bayleton, HWG 1608, Dithane, Tilt and Easout) were applied at various rates to plots which were staked out in a commercial field of 'Harrington' barley near Olds. All products were applied on July 8, 64 days after seeding, at Zadok's Growth Stage 50. A second application of Dithane was made on July 17. Tilt, HWG 1608 and Dithane provided the best disease control. The major disease present was net blotch (Pyrenophora teres). Scald (Rhynchosporium secalis) was also present but at low levels. No yield data were taken.

DISEASE SURVEYS

Evaluation of Leaf Disease Resistance in Barley Cultivars Under Field Conditions.

Ten barley cultivars (Johnston, Leduc, Klages, Samson, Bonanza, Harrington, Empress, Otal, Diamond and Heartland) were evaluated for leaf disease resistance. Each was replicated three times in a RCB design. A number of different leaf diseases were present. Net blotch, speckled leaf blotch and spot blotch were all grouped together during visual ratings due to the similarity in lesion types. Halo spot (Selenophoma donacis) was found infecting seven of the ten cultivars, with Harrington appearing to be the most susceptible. This is the first report of halo spot on barley in Alberta. Scald and powdery mildew were also present at fairly high levels. Based on final disease ratings, the varieties were rated as follows: Resistant (Johnston, Leduc), Intermediate (Bonanza, Empress, Diamond, Heartland), and Susceptible (Klages, Samson, Harrington, Otal).

Field Distribution of Barley Leaf Diseases.

Barley leaf diseases were examined along three transects through a field of 'Heartland' barley. Heartland has intermediate resistance to net blotch. The primary disease in the field examined was barley scald. Speckled leaf blotch was present, but at low levels. Disease levels were highest along the outside of the field and lowest along a strip through the middle. This disease distribution corresponded to the previous year's cropping pattern. Although the entire field had been seeded to barley in 1986, the middle strip was planted to 'Leduc' and the outside was planted to 'Galt'. Leduc has good resistance to both net blotch and scald, whereas Galt is very susceptible to these diseases. Even within these strips, disease levels varied substantially from 5%-50% leaf disease in the high-disease area, and from 2%-8% leaf disease in the low disease area. The variability in disease levels at different sampling points illustrates the importance of obtaining a representative sample when assessing a crop for disease.

Blackleg of Canola Survey in Alberta.

This survey was co-ordinated by I. Evans, Crop Protection Branch, Alberta Agriculture, Edmonton. One hundred and fifty-nine fields were surveyed prov- ince-wide, with the virulent strain of blackleg appearing in twelve fields located in Crop Districts 7 and 10. The RCL, Olds, surveyed 24 fields in Crop District 7. Three fields with the virulent strain of blackleg were found. This was the first time that the virulent strain has been found in Crop District 7.

A Survey of Canola Diseases in Southern Central Alberta.

Fifty-one fields were surveyed on September 8 and 11 in the counties of Red Deer and Mountain View and the Municipal District of Kneehill. Fields were surveyed after swathing, but prior to combining. Twenty-three percent of the fields were infested with the avirulent strain of blackleg, with a mean incidence of 0.37. Sclerotinia stem rot was present in 80% of the fields at a mean incidence of 2.37. Powdery mildew and grey stem were found in 42.0% and 45.0% of fields, respectively. Plants with signs of damage caused by an insect crown borer were found. Percent damage due to this unidentified insect was determined in 15 fields. Damaged plants were found in 93.0% of the surveyed fields, with a mean incidence of 8.0%. There have been no previous reports of this type of damage to canola in western Canada. This is a potentially serious problem that warrants immediate attention.

ENTOMOLOGY PROGRAM

Leader: R. Howard
Technologist: A. Tellier

OBJECTIVES

The Entomology Program conducts research and provides extension and diagnostic services. Research is directed toward major pest problems on selected horticultural crops. Extension assistance is provided to Alberta's agricultural industries, individual growers, and Alberta Agriculture extension staff. Diagnostic services are provided for clients of the ASCHRC Regional Crop Laboratory and ASCHRC researchers. Pest control recommendations are often made in conjunction with diagnoses and as the result of routine by commercial and amateur producers.

RESEARCH PROJECTS

GREENHOUSE PEST MANAGEMENT

Control of Western Flower Thrips Frankliniella occidentalis (Pergande).

The Western Flower Thrips (WFT), a major pest of long English cucumbers, caused serious losses to the Alberta greenhouse vegetable industry in 1987. The ASCHRC Entomology Program provided technical assistance, supervision and extension services in a WFT and predator monitoring project organized by M. Steiner, Alberta Environmental Centre, Vegreville, and D. Elliot, Applied Bio-Nomics, Sidney, B.C. Fifteen commercial greenhouses in Redcliff were monitored to evaluate the efficacy of a predatory mite, Amblyseius cucumeris, and chemical control. Ten producers used the mites for biological control of WFT and five used insecticides. Several problems were encountered throughout the year. For example, adequate supplies of predatory mites were not available at the beginning of the season, which forced many producers to spray insecticides. Furthermore, fall introductions of predatory mites were ineffective because they went into diapause. However, predators did estalish themselves at three sites and curtailed WFT populations. Control achieved at those three sites was equivalent to that achieved with insecticides at other sites.

Amblyseius cucumeris Diapause Studies.

Duration and intensity of lighting may play an important role in breaking diapause of A. cucumeris. To assess these effects, a fall crop of long English cucumbers was planted in November, 1987, in two ASCHRC greenhouses. One house was lit 24 h/day with a string of incandescent (100 W) bulbs and the other house was unlit. Amblyseius cucumeris was introduced to both houses, but the mites failed to establish themselves by year's end. This experiment will be repeated in the fall of 1988.

CONTROL OF FRUIT PESTS

Efficacy and Phytotoxicity of Insecticides on Saskatoons.

Saskatoons are subject to attack by a number of insect pests which may reduce fruit yield and quality. At present, there are few insecticides registered on this crop in Canada. In 1987, a field trial was carried out at ASCHRC to gather efficacy data. Assistance was provided by E. Moskaluk, ASCHRC, and J. Davidson, Agriculture Canada, Beaverlodge. Deltamethrin (Decis), diazinon (Basudin), and dimethoate (Dimethoate) were evaluated for their ability to control sawflies, thrips, leaf miners and pear slugs in an orchard of 'Smoky' saskatoons. The chemicals were applied as foliar sprays at, and following, flowering. Visual observations of pest damage were made during the growing season and berry yields were determined from treated and untreated plants. All bushes sprayed with dimethoate exhibited moderate to severe leaf burning and cupping. No phytotoxic effects were visible on bushes which were treated with the other chemicals. Berries from bushes which received dimethoate applications were small, somewhat shrivelled and less mature than berries from trees sprayed with other chemicals. None of the insecticides significantly affected the average number of berries per cluster or provided significant control of thrips, sawflies or pear slugs; however, all three significantly reduced overall insect damage to the berries. Decis and dimethoate controlled leaf miners significantly better than diazinon. Details of this study were reported in the 1987 Pesticide Research Report of the Expert Committee for Pesticide Use in Agriculture, Agriculture Canada, Ottawa.

PEST SURVEYS

Dutch Elm Disease/Elm Bark Beetle Survey.

Sixteen sites throughout southern Alberta were monitored for elm bark beetles. Pheromone and log traps were put out in early May and the last collection was made in mid-October. Pheromone traps were changed monthly. Unfortunately, two pheromone traps were lost in mid July due to heavy rains and wind. No elm bark beetles were picked up on pheromone or log traps. With the assistance of J. Emond, Northern Forestry Centre, Edmonton, investigations were conducted on a Siberian elm shelterbelt at the Del Bonita Port-of-Entry, where a specimen of the smaller European elm bark beetle Scolytus multistriatus, had been collected on a pheromone trap in 1986. The shelterbelt was checked regularly for evidence of bark beetle attacks and none was found. Seven truck loads of firewood confiscated at the U.S./Canada border were screened for elm logs and destroyed. Several logs were cultured for Ceratocystis ulmi and all proved negative, as did other samples submitted to ASCHRC from various urban locations in southern Alberta.

Cutworm Survey.

A survey for bertha armyworm, red-backed cutworm, dark-sided cutworm, and pale western cutworm was conducted in cooperation with M. Dolinski, Alberta Agriculture, Edmonton, and B. Byers, Agriculture Canada, Lethbridge. Traps were set out and changed periodically at several

locations in the Brooks area. Cutworm moths were sent to B. Byers for identification and tallying. Although moths of all four species were trapped at Brooks, the populations were well below economic thresholds. Cutworm moth populations across southern Alberta were generally low in 1987.

European Corn Borer Survey.

Six sites, two each near Brooks, Rolling Hills and Scandia, were monitored for European corn borer adults. Pheromone traps were set out on July 3 and checked weekly for four weeks. Traps were made of one litre milk cartons, painted with 'Tangle Foot', an inert sticky substance, and baited with Terochem pheromone lures (Terochem Laboratories Ltd., Edmonton). Similarly, six wing traps and lures from Phero-Tech Inc., Vancouver, B.C., were tested at the same sites. No moths were caught with the Terochem lures, but one was caught in a Phero-Tech wing trap. This survey was done in cooperation with S. Derenewski, Alberta Agriculture, Medicine Hat.

EXTENSION AND SERVICE PROGRAMS

A. Tellier attended the American Greenhouse Vegetable Growers' Association Annual Convention in Richmond, B.C. (August 11-14). A. Tellier assisted apiary inspectors in conducting Acarine mite surveys of honeybee colonies in southern Alberta and with carbofuran residue sampling of honeycombs. Assistance with insect identification was provided to staff of the ASCHRC Regional Crop Laboratory.

ABSTRACTS

In Report to the Committee on Horticultural Research, Canadian Horticultural Council. March, 1988.

- Weed Control in Nursery Container Stock. R. Esau
- Efficacy of Herbicides for Squash. R. Esau
- Day-Neutral strawberry cultivar trials. L. Hausher
- Strawberry cultivar trials. L. Hausher
- Efficacy of fungicides against powdery mildew of oak-leaf ivy. R. Howard, E. Moskaluk, and T. Allen
- Removal of visible fungicide residues from the foliage of grape and oak-leaf ivies. R. Howard, E. Moskaluk, and T. Allen
- Efficacy and phytotoxicity of insecticides on saskatoon. R. Howard, E. Moskaluk, and J. Davidson
- Screening of processing pea cultivars for resistance to root rot. R. Howard and E. Moskaluk
- Processing quality of small white beans. M. S. Kaldy, R. G. Gaudiel, and S. J. Park
- Saskatoon Fruit Leather. T. Smyrl and M. Dench
- Dutch Elm Disease and Elm Bark Beetle Survey, 1987. A. Tellier

In Research Report, Expert Committee on Weeds (Western Canada Section). December. 1987. Abstracts by R. Esau

- Dicamba Plant Back Study - Wheat
- Nightshade Control in Dry Beans
- Dicamba Plant Back Study - Lentil
- Grassy Weed Control in Processing Peas
- Weed Control in Processing Peas
- Weed Control in Cabbage
- Graminicides For Use in Cucumbers
- Efficacy of Three Herbicides for Squash With or Without Plastic Mulch
- Postemergence Treatments for Weed Control in Onions
- Tolerance of Onions to Bromoxynil
- Grassy Weed Control in Potatoes
- Weed Control for Spiraea Container Stock
- Weed Control for Juniper Container Stock
- Weed Control for Alpine Current Container Stock
- Recropping AC 263,499 Treated Soil to Canola

In Pesticide Research Report, 1987. Expert Committee for Pesticide Use in Agriculture, Agriculture Canada, Ottawa. January, 1988.

- Phytotoxicity and efficacy of insecticides on saskatoons, 1987. R. J. Howard, E. R. Moskaluk, and J. G. N. Davidson
- Efficacy and phytotoxicity of fungicides on saskatoons, 1987. R. J. Howard, E. R. Moskaluk, and J. G. N. Davidson
- Evalutation of the phytotoxicity of soil-applied fungicides on Cissus rhombifolia, 1987. R. J. Howard, E. R. Moskaluk, and T. Allen

- Evaluation of the phytotoxicity and visible residues of fungicides applied to the foliage of Cissus rhombifolia, 1987. R. J. Howard, E. R. Moskaluk, and T. Allen
- Removal of visible fungicide residues from the foliage of Cissus rhombifolia, 1987. R. J. Howard, E. R. Moskaluk, and T. Allen
- Efficacy of fungicides against powdery mildew of Cissus rhombifolia, 1987. R. J. Howard, E. R. Moskaluk, and T. Allen
- An evaluation of two fungicides and two application methods for the control of white mold on dry peas, 1987. R J. Howard and E. R. Moskaluk
- Seed treatment evaluation for loose smut control in Galt barley, 1987. D. D. Orr, S. Slopek, J. G. N. Davidson and P. D. Kharbanda
- Seed treatment evaluation for common root rot control in Galt barley, 1987. D. D. Orr, S. Slopek, and P. D. Kharbanda.

RESEARCH REPORTS

ASCHRC Pamphlet Series

Crowe, N. L. 1987. Report of the Food Processing and Quality Evaluation Program. ASCHRC Pamphlet 87-16.

Dykstra, M. D. 1987. Regional Crop Laboratory Report, 1987. ASCHRC Pamphlet 87-13.

Esau, R. and V. Rumney. 1986. Weed Control Trials 1986. ASCHRC Pamphlet 87-10.

Hausher, L. G. 1987. Fruit Crop Trials. ASCHRC Pamphlet 88-6.

Hausher, L. G. 1987. Sources of Fruit Cultivars. ASCHRC Pamphlet 87-7 (revised).

Howard, R. J. and E. R. Moskaluk, 1987. Plant Pathology Program Report, 1986. ASCHRC Pamphlet 87-18.

Mallett, K. I. 1987. Post-Harvest Program Report, 1986. ASCHRC Pamphlet #87-15.

Ragan, P. 1987. Vegetable Cultural Trials, 1987. ASCHRC Pamphlet 88-4.

Ragan, P. 1987. Vegetable Cultivar Trials, 1987. ASCHRC Pamphlet 88-5.

SCIENTIFIC PAPERS

McKenzie, R. C., W. Chomistek, and N. F. Clark. 1987. Calibration of electromagnetic inductance readings to saturated paste extract values for soils having different temperature, texture, and moisture conditions. Submitted to Can. J. Soil Sci. and published in Western Canadian Salinity Procedures Manual published by Alberta Agriculture and the PFRA. 10 pp.

McKenzie, R. C., D. C. Penny, L. W. Hodgins, B. S. Aulakh, and H. Ukrainitz. 1988. The effects of liming on an Ultisol in northern Zambia In Communications in Soil Science and Plant Analysis. In Press. 15 pp. Presented at International Conference on Acid Soil Plant Relations, Grande Prairie. July, 1987.

McKenzie, R. C., W. Chomistek, and N. F. Clark. 1987. Tolerance of irrigated and dryland wheat to soil salinity as measured by several methods. Submitted to Can. J. Soil Sci. 18 pp.

SELECTED REPORTS

Beasley, B., R. Gaudiel, and D. J. Major. 1987. Corn Hybrid Trials, Alberta Corn Committee.

Esau, R. 1987. Western Canadian Society for Horticulture, Report of Proceedings of Forty-Second Annual Meeting held at Winnipeg, Manitoba. February 18-21, 1986.

Esau, R. 1987. Expert Committee on Weeds (Western Section) Minutes of Annual Meeting held at Saskatoon, Saskatchewan, November 25-27, 1986.

Gaudiel, R. 1987. Herbs and Spices - A Status Profile. Report prepared for the Alberta Action and Steering Committees. December.

Mallett, K. I. (Editor) 1987. 1986 Annual Report. Alberta Special Crops and Horticultural Research Center. Brooks.

Mallett, K. I. 1987. Disease Screening for the Prairie Potato Breeding Program. Proc. Prairie Potato Council Annual Meeting (1987), Regina, SK.

McKenzie, R. C. 1987. Water use of vegetables. Published in Proceedings Can. Soc. of Hort. Sci. Annual Meeting, London, Ont.

McKenzie, R. C. 1987. Tolerance of plants to soil salinity in Western Canada Salinity Procedures Manual published by PFRA and Alberta Agriculture.

McKenzie, R. C. 1987. Conversion of salinity readings obtained by the 1:2 soil-to-water suspension method to saturated paste extract equivalents In Soil Test Recommendations for Alberta, A Technical Manual.

PRESENTATIONS

Presented at Professional Meetings.

Dykstra, M. D. 1987. Diagnostic Methods. Workshop on Diagnosing Plant Diseases, Vegreville. February.

*Esau, R. 1987. Effects of Chlorsulfuron on Succeeding Rotational Crops. Chemistry and Biochemistry of Herbicides Workshop. Vegreville. April.

Gaudiel, R. 1987. Special Crops Research Activities in 1986 - ASCHRC. Expert Committee on Grain Breeding. Edmonton. February.

Howard, R. J. and E. R. Moskaluk. 1987. Verticillium Wilt Survey of Alfalfa Fields in Southern Alberta in 1987. Annual Meeting of the Plant Pathology Society of Alberta. Lacombe. October.

Howard, R. J., M. Dykstra, C. Krause, and C. Linowski. 1987. The Southern Alberta Regional Crop Laboratory Report. Annual Meeting of the Plant Pathology Society of Alberta. Lacombe. October.

Mallett, K. I. and L. M. Harrison. 1987. The Genetic Relationship of Fairy Rings. Annual Meeting of the Plant Pathology Society of Alberta. Lacombe. October.

Mallett, K. I. 1987. Disease Screening for the Prairie Potato Breeding Program. Annual Meeting of the Potato Council, Regina, SK. February.

Slopek, S. W. A few thoughts on cereal leaf diseases. Annual Meeting of the Plant Pathology Society of Alberta. Lacombe. November.

Tellier, A., M. Steiner, and D. Elliott. Thrips and Predators Monitoring Program on Greenhouse Cucumbers. Entomological Society of Alberta Annual Meeting. Drumheller. October.

PRESENTED TO ADVISORY COMMITTEES

Gaudiel, R. 1987. Progress Report of Some Pulse Crop Trials in 1987. Alberta Pulse Crop Advisory Subcommittee. Lethbridge. December.

Gaudiel, R. 1987. Progress Report of Some Special Crop Trials in 1987. Alberta Special Crops Advisory Committee. Lethbridge. December.

Hausher, L. G. 1987. Update on Horticulture Extension Activities at ASCHRC. Horticulture Extension Advisory Committee Meeting. Edmonton. October.

McKenzie, R. C. 1987. Progress Report on Safflower and Lentil Irrigation Trials. Special Crops Advisory Committee. Lethbridge. December.

Najda, H. G. 1987. ASCHRC Forage Research Update. Annual Meeting of the Alberta Forage Advisory Committee. Edmonton. November.

Slopek, S. W. Disease situation in South-Central Alberta. Alberta Cereals and Oilseeds Advisory Committe. Lacombe. December.

*Abstract not available.

PRESENTED AT GROWERS' AND AGRI-BUSINESS MEETINGS AND COURSES

*Esau, R. 1987. Weed Control in Saskatoons. Grande Prairie. June.

*Esau, R. 1987. Weed Control in Potatoes. Seed Potato Production Seminar. Edmonton. January.

*Esau, R. 1987. Tolerance of Potato Cultivars to Metribuzin. York Farms - Chipman Chemicals Potato Production Seminar. Taber. March.

Esau, R. and J. R. Moyer. 1987. Chlorsulfuron (Glean) Persistence in Southern Alberta. Poster presentation at Alternative Crops Conference. Lethbridge. November.

Esau, R. and J. R. Moyer. 1987. Effects of Chlorsulfuron on Alternative Crops in southern Alberta. Poster presentation at Expert Committee on Weeds (WC). Victoria, B.C. December.

Gaudiel, R. 1987. Sunflower Hybrids and Population. Sunflower School. Taber. February.

Gaudiel, R. 1987. Bean Varieties and Pointers for Successful Production. Alberta Wheat Pool Bean Seminar. Bow Island. February.

Gaudiel, R. 1987. Fertilization of Special Crops. Growers' Meeting. Vauxhall. March.

Gaudiel, R. 1987. Alternate Crops. Unifarm Growers' Meeting. Hussar. March.

Gaudiel, R. 1987. Special Crops for Central Alberta. Growers' Meeting. Didsbury. November.

Gaudiel, R. 1987. New Crops - An Overview. Alternative Crops Conference. Lethbridge. November.

Gaudiel, R. 1987. What's New in Drybean Varieties. Alternative Crops Conference. Lethbridge. November.

Gaudiel, R. 1987. Herbs and Spices - An Overview. Alternative Crops Conference. Lethbridge. November.

Gaudiel, R. 1987. Essential Oils. Alternative Crops Conference. Lethbridge. November.

Gaudiel, R. 1987. Zinc Deficiency in Drybeans. A Poster. Altnerative Crops Conference. Lethbridge. November.

Hausher, L. G. 1987. Beginning Fruit Production. Commercial Saskatoon Production. Alberta Horticultural Congress. Red Deer. November.

---

*Abstract not available.

Hausher, L. G. 1987. Strawberry Production and Marketing. Raspberry Production and Marketing. Commercial Strawberry/Raspberry Production Course. Red Deer, Edmonton, Grande Prairie. January.

Hausher, L. G. 1987. Mulch and Tunnel Use and Recommendations for Alberta. Update on Mulches and Tunnels for Commercial Grower Course. Red Deer. March.

Hausher, L. G. 1987. Pruning of Fruit Trees and Shrubs. Pruning Course. Brooks. March.

Howard, R. J. 1987. Disease Management in Dry Beans. Alternative Crops Conference. Lethbridge. November.

Howard, R. J. 1987. Update on Verticillium Wilt of Alfalfa in Alberta. Sixth Annual Canadian Alfalfa Seed School. Edmonton. January.

*Howard, R. J. 1987. Diseases of Soft Wheat and Their Control. Soft Wheat Seminar. Vauxhall. January.

*Howard, R. J. 1987. Control of Sclerotinia White Mold Using Fungicides. Pulse Growers' Association of Alberta Winter Seminar and Annual Meeting. Lethbridge. January.

*Howard, R. J. 1987. Diseases of Field Crops and Their Control. Taber Seed Plant Crop Production Meeting. Taber. February.

*Howard, R. J. 1987. Field Crop Diseases and Their Control. Insect and Disease Seminar. Medicine Hat. February.

*Howard, R. J. 1987. Major Diseases of Field Crops and Methods for Their Control. Seminar on Field Crop Diseases. Bow Island. February.

*Howard, R. J. 1987. Major Diseases of Field Crops and Methods for Their Control. Seminar on Field Crop Diseases. Bow Island. February.

*Howard, R. J. 1987. Major Diseases and Insect Problems on Wheat. Wheat Information Day. Oyen. February.

*Howard, R. J. 1987. Disease Control in Greenhouse and Interior Plantscapes. Class J Pesticide Applicators' Course. Calgary. March.

*Howard, R. J. 1987. Crop Diseases and Their Control. Crop Production Club Meeting. Claresholm. March.

Howard, R. J. 1987. Implications of Reduced Tillage no the Management of Crop Diseases. Annual Meeting of the Alberta Conservation Tillage Society. Calgary. March.

---

*Abstract not available.

*Howard, R. J. 1987. Procedures for Disinfestation of Leafcutter Bee Equipment. Workshop for Alfalfa Seed and Leafcutter Bee Producers. Brooks. April.

*Howard, R. J. 1987. Identification of Major Potato Diseases. Annual Seminar for Potato Inspectors. Brooks. July.

Howard, R. J. 1987. Disease Management in Dry Beans. Alternative Crops Conference. Lethbridge. November.

*Howard, R. J. 1987. Disease Detection in Greenhouse Crops. Alberta Horticultural Congress and Trade Show. Red Deer. November.

Mallett, K. I. 1987. Potato Diseases and Their Control. Seed Potato Production Short Course. Edmonton. January.

Mallett, K. I. 1987. Common Diseases of Ornamentals and Shelterbelt Trees. Pruning Course. Brooks. March.

Mallett, K. I. 1987. Research Update. LANTA Growers' Group Meeting. Airdrie. March.

Mallett, K. I. 1987. Potato Disease Survey - 1986. York Farms Growers Workshop. Lethbridge. March.

McKenzie, R. C. 1987. Effect of water and nitrogen on yield and quality of potatoes. Prairie Potato Council. Regina, Sask. February.

McKenzie, R. C. 1987. Economics of Irrigation of Special Crops. Alternative Crops Conference. Lethbridge. November.

McKenzie, R. C. 1987. Fertilizer Management in Cereal Production. John Deere Farm Meeting. Bassano. March.

McKenzie, R. C. 1987. Winter Wheat Production. Castor. February.

McKenzie, R. C. 1987. Water and Fertility Management of Potatoes. Taber. February.

Moskaluk, E. R. 1987. Field Diagnosis of Verticillium Wilt of Alfalfa. Workshop for Inspectors of the Food Production and Inspection Branch, Agriculture Canada. Rolling Hills. July.

*Najda, H. G. 1987. Forage Seed Production in Alberta. Manitoba Forage Seed Producers' Association Annual Meeting. Arborg, Manitoba. July.

Schaupmeyer, C. 1987. Nitrogen Survey Results, 1986. York Farms Potato Workshop. Taber. March.

Schaupmeyer, C. 1987. Seed Lot Uniformity. Seed Potato Growers Workshop. Edmonton. January.

---

*Abstract not available.

Schaupmeyer, C. 1987. Seed Lot Uniformity. York Farms Potato Workshop. Taber. March.

Schaupmeyer, C. 1987. Seed Lot Uniformity. Alberta Potato Conference. Lethbridge. November.

Schaupmeyer, C. 1987. Potato and Vegetable Production in Alberta. Alternative Crops Conference. Lethbridge. November.

Schaupmeyer, C. 1987. Potato Cultivar Trial Results. Potato Cultivar Evaluation and Potato Research Field Day. Brooks. August.

Slopek, S. W. 1987. Insect pests of seed potatoes. Alberta Seed Potato Growers' Meeting. Edmonton. January.

Slopek, S. W. 1987. Barley leaf diseases. Western Barley Growers' Association Meeting. Calgary. February.

Slopek, S. W. 1987. Root and leaf diseases of barley. Field Crops Course. Olds College. February.

Slopek, S. W. 1987. Biotic diseases. Diagnostic Course, Alberta Environmental Centre, Vegreville. February.

Slopek, S. W. 1987. Barley diseases. Parkland Growers, Madden. March.

Slopek, S. W. 1987. Barley diseases. Parkland Growers, Lone Pine. March.

Slopek, S. W. 1987. Field Crop Diseases. Disease Identification Workshop. Olds. June.

Slopek, S. W. 1987. Field Crop Diseases. Disease Identification Workshop. Innisfail. June.

*Tellier, A. J. 1987. Insect Pests of Trees and Shrubs. Pruning Course. Brooks. March.

EXTENSION BULLETINS, FACTSHEETS, AND PAMPHLETS

Beasley, B., R. Gaudiel, B. Roth, and M. MacDonald. 1987. 1988 Corn Hybrid Recommendation List. Alberta Corn Committee Publication.

Blenis, P., Y. Hiratsuka, and K. Mallett. 1987. Armillaria root rot in Alberta. Agric. & Forestry Bull. 10(1):4-5.

Howard, R. J. and M. D. Dykstra. 1987. Diseases of Interiorscape Plants in Alberta. Agric. & Forestry Bull. 10(1)22-24.

---

*Abstract not available.

Roth, B., R. Gaudiel, and B. Park. 1987. Lentil Production in Alberta. Alberta Agriculture, Edmonton. Agdex 142/20-5.

Roth, B., R. Gaudiel, and B. Park. (Prepared by) 1987. Varieties of Special Crops for Alberta. Alberta Agriculture, Edmonton. Agdex 140/32-1.

NEWSLETTERS

Hausher, L. G. 1987. Fruit Facts. ASCHRC. Monthly.

Howard, R. J., R. Esau, K. I. Mallett, A. J. Tellier, M. D. Dykstra, and C. E. Linowski. 1987. Crop Protection Newsletter (Southern Alberta). Vol. 11 (1-12). ASCHRC. Monthly.

Slopek, S. W. 1987. Crop Protection Newsletter (Central Alberta). Vol. 4 (1-6). Bimonthly.

PERIODICALS AND OTHER NEWSLETTERS

Gaudiel, R. 1987. Cereals and Oilseeds Varietal Tests at Acadia Valley. Supplementary Project Report 1986. CARA, Oyen.

Hausher, L. G. 1987. Strawberry Production - Is It For You? The Fruit Grower, Winter, Vol. 3, No.1.

Hausher, L. G. 1987. Commercial Raspberries on Increase. The Fruit Grower, Spring, Vol. 3, No. 2.

Hausher, L. G. 1987. Survival Problems in Saskatoon Suckers. The Fruit Grower, Summer, Vol. 3, No. 3.

Hausher, L. G. 1987. Saskatoons as a Garden Fruit. The Prairie Garden.

Slopek, S. W. 1987. Sclerotinia Stem Rot: To Spray or Not to Spray. Alberta Canola Grower. June, 1987.

APPENDIX I.

METEOROLOGICAL REPORT

Summary of 1987 Weather Conditions

The 1987 spring was early, with temperatures in April averaged 3.6° above normal. Plant growth, particularly that of woody ornamentals promoted by the warm temperatures, was severely damaged by a heavy frost on May 19, when temperatures dropped to -6°C for an extended period of time.

A growing season, with below average temperatures in July and August and above average temperatures in September and October, followed. Rainfall during August was over 2½ times the average. The fall killing frost occurred on October 5, giving the Brooks area a growing season of 137 days. Total heat unit accumulation was 2434 corn heat units.

Table 5. Maximum, minimum, and mean temperatures (°C) at the Alberta Special Crops and Horticultural Research Center, Brooks, 1987.

	Max.	Min.	Mean	Prec. (mm)	Sunshine (h)
January	14.5	-25.0	-2.9	4.3	121.5
February	15.0	-20.0	-1.5	4.0	132.8
March	21.0	-16.0	-0.3	28.1	85.9
April	29.0	-6.0	8.8	11.6	257.8
May	29.0	-6.0	12.9	26.8	292.0
June	33.0	4.5	17.9	22.1	306.8
July	34.0	6.0	17.9	43.2	296.1
August	29.5	2.0	14.6	102.6	257.2
September	32.5	-0.5	13.5	15.7	247.1
October	27.0	-8.0	6.9	6.8	187.4
November	17.0	-16.0	1.5	5.6	118.0
December	14.0	-28.0	-3.9	6.6	101.3